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# DISCOVERY

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IN THIS ISSUE

## Plants in Medieval Art

By Professor A. C. Seward

◆

## Iceland and her Rivers

By R. Ansell Wells

◆

The Nightingale in Devon. By E. W. Hendy

◆

Everest : the Fifth Assault — Photo-Electric Exposure Meters — Post-Eruptive Movements of the Earth's Crust — The Classroom Film

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(*Continued on page xliii*).

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## Notes of the Month.

The priceless treasures of Chinese art, which have gladdened the eyes of Londoners during the past winter, are now on their way home to the East. In view of the uncertainties of many international arrangements nowadays, it is a matter for congratulation that the convoy of these treasures to their home has been entrusted to the Royal Navy, while their actual conveyance is, on this occasion, in the hands of the British Mercantile Marine, represented by the P. & O. steamship *Ranpura*. It is a compliment to the Royal Navy that the insurance charges are very much less heavy than they would have been had the transport been carried out without the safeguard of its vigilance. Even in the present circumstances, the *Ranpura*, with its precious load, is subject to ordinary sea-risks, and the weather in the Straits of Gibraltar did not temper its fury when she passed through. The slight mishap which led to the vessel running aground in Algeciras Bay would have passed almost unnoticed had the cargo been more usual; and its safe negotiation has only served to emphasise the fine seamanship which can take such situations in its stride.

* * * *

There is another side to the picture, however, and that is the cost of maintaining so efficient a naval service. The *Pacific Islands Monthly* reports a lamentable state of affairs in the New Hebrides, which are under the control of an Anglo-French Condominium. The New Hebrides, as far as the British side of the administration is concerned, appear to be a very Cinderella among colonies; little interest seems to be taken by the authorities in the British planters there, and their number has dwindled to about 100. Whereas the French Government has assisted its New Hebridean citizens in times of depression, after hurricanes, and so on, the British planters have met with nothing but apathy, coupled with a few galling restrictions. Land titles have taken 20 years or more to prepare, and fees for non-existent surveys have been charged; some planters have actually adopted French nationality as the easiest way out. Meanwhile, a complete colonial administration is kept up at a high cost in order to ensure the availability of the magnificent harbours of the group. Were it not for our connection with the Condominium, we should have no naval harbours between Fiji and the Solomons. The arrangement certainly seems a clumsy one, and it would surely be possible to hand over all the land rights to France, reserving a free right of entry to the harbours. Almost anything would be better than the present regime, which simply brings the British colonial administration into disrepute.

* * * *

The First Commissioner of Works has quickly followed up the success of Vol. I of the illustrated regional guides to ancient monuments under the control of H.M. Office of Works. Vol. II, issued in April, covers the monuments of Southern England as far north as the line, Bristol-Oxford-London. Whereas in the Northern England volume the most important monuments were mainly of ecclesiastical origin, here only Netley Abbey is comparable to the great Yorkshire foundations; and it is the splendid series of castles that strikes the reader most forcibly. Prehistoric remains are likewise of high importance. One of the most welcome additions to the accessible antiquities of the realm is Dover Castle, which contains within its walls examples of building of almost every period from the Roman downwards, but, though familiar in general outline, was, until recently, open only to privileged visitors. The reproduction of

the illustrations shows a marked improvement. The guide is published by H.M. Stationery Office at the price of one shilling.

* * * *

The Ordnance Survey have published a new map of the Peak District and its approaches, on the scale of ½-inch to 1 mile. An exceptionally generous reading has been taken of the meaning of the word "approaches," and the map extends from Liverpool and the manufacturing districts of Lancashire on the north, to Burton-on-Trent on the south, while Nottingham and the borders of Denbighshire are included on the east and west sides. The detail is remarkable for both clearness and quantity, and this map should prove of the highest value to motorists visiting the lovely heart of the English Midlands. The map may, as usual, be procured in several styles of mounting, ranging in price from 2*s.* to 4*s.* 6*d.*

* * * *

Not only does this map cover more than double the area of the normal ½-inch sheet (4,292 sq. miles as against 1,944), but several new features have been introduced. Woods are shown by a green colour only—the "tree" symbols have been omitted; the Transverse Mercator Projection is used; roads are revised quite up to date and Ministry of Transport numbers have been inserted; "National Trust" areas are shown; and, finally, layer tints below 500 feet have been omitted, while above that point they are shown at 250-feet intervals.

* * * *

Under the title, *France: a Handbook for Beginners in French* (Heffer. 1*s.*), Dr. Cloudesley Brereton has published, in booklet form, the material contained in three of his wireless lectures, originally delivered in London, and afterwards repeated by the author from Paris at the invitation of the French Government. Dr. Brereton has performed a notable service to the cause of mutual understanding between nations, a cause which was never more important than at the present time. Probably no one but the author could have spoken so much to the point in so little space, and his words provide an admirable background for the study of the land and the people. Moreover, while the material is presented in a way that can be understood by any reader, he would be a bold man who would say that he has heard it all before, when such scholars as André Siegfried and Horsfall Carter have admitted that from it they have learnt something new about France. An admirable shillingsworth; read and re-read it.

The 1936 Mount Everest Expedition is now well on its way; and it may be that within a month or so we shall be recording the experiences of the first men to reach the highest summit on Earth. In the pages of this issue we publish an appreciation of the situation in the light of previous parties' experience; and, given a trained body of climbers and porters (and nobody doubts we have that), it all comes down, for practical purposes, to a question of weather—when will the monsoon arrive? There is just one incalculable feature: the effect of very high altitudes on the psychology of men indulging in hard physical labour. We are all at the mercy of our bodies, and nobody is quite sure what effect the reduced atmospheric pressure of the last thousand feet may have on the nervous centres of the toiling climbers. So far we must rest content with the knowledge that the climbers are well aware of the danger and are steeled to resist the assault of the mountain on both body and soul.

* * * *

A report in a recent issue of *The Times* draws attention to the danger threatening Oldbury Hill, the woodland plateau between Sevenoaks and Ightham, in Kent, which, it is stated, is shortly to be offered for sale as a building site. Efforts, up to the moment not markedly successful, are being made to preserve the site for the Nation, and all interested in the archæology of England should do what they can to help. Not only is Oldbury Hill the site of an important prehistoric fortress, but also it was the scene of the lifelong archæological researches of Benjamin Harrison; and therein lies the real heart of the present trouble. Even though the fortress itself is protected by the Ancient Monuments Act, the occupation of the land by houses would mean the covering up of the high-level gravels in which Harrison discovered those coliths that gave proof of the oldest human culture in this island. A priceless source of evidence would be lost to archæology for ever, and students of the future would be driven to the unsatisfying expedient of reading about it in books.

* * * *

Messrs. Hutchinson & Co., Ltd., the original publishers of *The Confessions of a Capitalist*, by Sir Ernest Benn, announce that on May 14th the book is to be included in their Booklovers' Library. This makes the thirteenth English edition of *The Confessions*, in addition to eight separate foreign translations. Although *The Confessions* is now more than ten years old, its popularity as a standard exposition of orthodox economics continues to grow.

# Plants in Medieval and Ancient Art.

**By A. C. Seward, Sc.D., F.R.S.**

*Professor of Botany in the University of Cambridge.*

*This article is written by a botanist who has derived no little pleasure from an excursion into a field which belongs to art rather than to science. Its main purpose is to draw attention to a subject which can hardly fail to make an appeal to lovers of nature with a predilection for plants.*

Most people are familiar in a general way with leaf-forms in architectural ornament: the acanthus, vine, and palm of Greek and Roman buildings; the conventional three-lobed leaf that is a distinctive feature of 13th century cathedrals and churches in this country; the much more realistic leaves, flowers, and fruits of the two last decades of the 13th and the early days of the 14th centuries. In France the naturalistic treatment of plants began at an earlier date than in England. This is apparent when one compares the sculpturing of capitals in contemporary French and English abbeys and cathedrals. The naturalistic rendering of plants, beginning before the end of the 11th century in the Abbey Church of Cluny, continued in the Cluniac Abbey of Vézelay in Burgundy, and adopted by the master masons of the 12th and 13th centuries, shows that there was a widespread desire to take living plants as models. This French fashion may be said to have reached its culminating point in the cathedral of Reims about the middle of the 13th century or rather later. In England we find decorative designs in Norman buildings that are in part derived from plants and often reminiscent of Byzantine, Classical, or Scandinavian patterns, but naturalistic treatment is lacking. Similarly, in the cathedrals of the Early English period there may be little ornament beyond deep-cut moulding or the restrained employment of conventional designs based on plants but not copied from nature. A cursory inspection of 14th century sculpture and that of the 15th century suffices to show that the craftsmen, following the short naturalistic period (*c.* 1280-1300), reverted to a more uniform treatment of plant form. The main point is that in France the master masons sought inspiration from nature at a much earlier age than in England. We are not at present concerned with the relative beauty of the two methods of modelling capitals, spandrels, and tympana, but with the comparatively short duration in England of an art which is usually spoken of as naturalistic.

[Photo: J. Crowther Cox.

*Capital in Southwell chapter-house, with naturalistic* Ranunculus *foliage.*

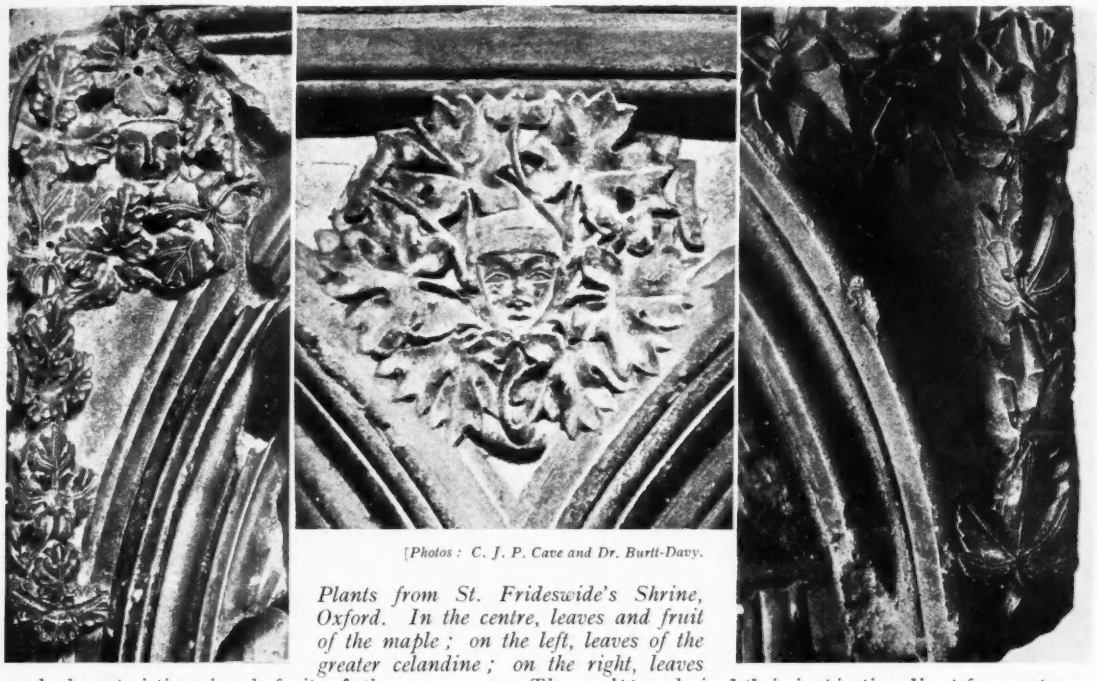
Why, it may be asked, should we trouble to study the naturalistic work of the medieval craftsmen? There is some satisfaction in matching leaves in stone with the foliage of a tree or herbaceous plant still growing in the neighbourhood of a cathedral and picturing the master mason gathering the living models. But this is only one aspect of a fascinating and not unfruitful branch of decorative art. We should like to know whether the hedge maple (*Acer campestre*), hawthorn, bryony, rose, hop, oak, ivy, ranunculus, and other plants were selected because they were ready to hand and things of beauty worthy of the sculptor's art, or whether selection was influenced by symbolism, by some association with legend and biblical history. Many of the plants on capitals, mouldings, and string-courses are members of the native flora: others are plants known only in cultivation. Moreover, from the leaves and

fruits we learn something of interest about the history and distribution of native as well as introduced plants. Flowers of the rose are among the commonest and most persistent emblems. Omitting any reference to classical patterns that may well be based on this favourite flower, we find double roses on the Norman door of Iffley Church (*c.* 1160); in some examples of late 13th century carving, *e.g.*, in Southwell Cathedral, roses with two series of petals, and in later work, for example, at the beginning of the 16th century in King's College Chapel, Cambridge, roses with many series of petals. These were not taken from plants in the hedgerows but from cultivated double roses.

It is probably true to say that the most striking examples in England of naturalistic sculpture are to be found in the chapter-house of the Cathedral of Southwell, a small town of Nottinghamshire, "a place passed by on the other side by a hurrying world." The octagonal chapter-house was built at the end of the 13th century (*c.* 1295). The recent publication in the *Proceedings of the Cambridge Antiquarian Society* (Vol. XXXV, 1935) of the results of an attempt by the writer to identify the Southwell plants renders unnecessary more than a passing reference to this splendid monument of medieval art. The first illustration, reproduced from a photograph given to me by Mr. J. Crowther Cox, F.R.P.S., of Rotherham, shows a capital adorned with foliage shoots, which are believed to have been taken from *Ranunculus repens*. Different forms of ranunculus occur on several of the capitals and tympana, in several instances associated with flowers, some of which agree closely with buttercups, but others are more like *Potentilla*. It is certain that flowers and foliage were sometimes unnaturally mixed and taken from different plants: this is an ancient practice going back to the Minoan Age. An exceptionally attractive example of naturalistic work may be seen on the spandrels of the arcading on the pedestal of St. Frideswide's shrine between the Lady Chapel and the north choir-aisle in Christ Church Cathedral, Oxford. In 1289 the bones of St. Frideswide, who died in the 8th century, were transferred to a new shrine enriched with the foliage of woodland plants: this was hacked to pieces in 1538 and, after an interval of more than 300 years, the fragments were collected and pieced together. The pedestal, though incomplete and partially defaced, but, fortunately, with very little restoration, is a precious relic, described by the late Professor E. S. Prior as being enriched with "the most exquisite leaf carving of any medieval monument." The masons of Oxford and Southwell were probably at work at the same time; their methods of treatment were different: at Southwell, deep undercut foliage; on the Oxford shrine, leaves and fruit in half relief. Some of the Oxford plants occur on the Southwell capitals, others, such as the greater celandine, the columbine, and the sycamore, are confined to the Oxford shrine. A list of the plants was published by Mr. S. A. Warner and Dr. Druce's identifications are given on a card placed on the pedestal. More recently, Dr. Burtt-Davy and Dr. Gunther published lists of the Oxford plants in *Nature*, July 14th, and August 11th, 1934. It is easy to identify the columbine, hawthorn, bryony (*Bryonia dioica*), the greater celandine, *Ranunculus*, oak, maple, and sycamore. Dr. Druce's list includes fig, but Dr. Burtt-Davy expresses doubt: it is almost certain that the leaves attributed to *Ficus* are those of maple seen from below. I have not seen any undoubted fig leaves either at Southwell or Oxford. The first two pictures on p. 135 are from photographs taken for me by my friend, Mr. C. J. P. Cave. One shows foliage of the greater celandine (*Chelidonium majus*) on one of the spandrels. The maple, represented by leaves and fruits in the other, was one of the favourite models in the last two decades of the 13th century and at a later date: the position of the winged fruits at right-angles to the peduncle is a characteristic feature. The most interesting of the St. Frideswide plants is sycamore (*Acer pseudoplatanus*), seen in the third picture, reproduced from a photograph kindly supplied by Dr. Burtt-Davy and published by him in *Nature* with an interesting

[*Photo: S. Smith.*

*Conventional "stiff leaf" ornament of the 13th century, from Lincoln Cathedral.*



[*Photos : C. J. P. Cave and Dr. Burtt-Davy.*

*Plants from St. Frideswide's Shrine, Oxford. In the centre, leaves and fruit of the maple ; on the left, leaves of the greater celandine ; on the right, leaves and characteristic winged fruit of the sycamore. The sculptors derived their inspiration direct from nature.*

note on the history of the tree. A good drawing of the same spandrel of the shrine may be found in Professor Prior's *A History of Gothic Art in England* (1900). It is generally believed that the sycamore is not native in Britain : its home is in the Pyrenees, the Alps, Carpathians, Asia Minor, Armenia, and the Caucasus. One writer quoted by Dr. Burtt-Davy states that it was probably introduced in the 16th century. One may reasonably conclude that the accurate reproduction of the foliage and the familiar Y-shaped fruits—in contrast to the T-shaped fruits of the maple—on St. Frideswide's shrine affords evidence of its occurrence in the neighbourhood of Oxford at least a few years before the end of the 13th century.

Another example of naturalistic sculpture, approximately of the same date as that at Southwell and Oxford, is the tomb of Bishop Cantilupe, who died in 1282, in the north transept of Hereford Cathedral. Many of the Hereford leaves are rather less naturalistic and by no means easy to identify with confidence. Other examples might be quoted in support of the contention that, in the short period at the end of the 13th century and in the early days of the 14th century, the master masons chose their subjects direct from nature. At a later date, as Dr. Coulton says in his book, *Art and the Reformation*, shop patterns were freely used, and foliage, though obviously based on the vine, oak, hawthorn, and several other plants, was often distorted in form and the surfaces represented with bulbous swellings. In recent years the admirable work of Mr. Cave has called attention to a source of information which promises considerably to increase the number of plants and animals known to have been selected by medieval craftsmen. Mr. Cave, having devised a successful technique, took a very large number of photographs of bosses in the vaulted roofs of cathedrals and thus made possible for the first time an intensive study of plant and animal groups beyond the reach of unaided vision. He has already published illustrations of a selected number of bosses, *e.g.*, at Gloucester and Ely, but there remains a mass of material awaiting description. One is impressed by the skill and care lavished on these intricate designs adapted to the form of the bosses and destined for positions where the quality of the work could, obviously, not be fully appreciated. On one of the bosses in the roof of Exeter Cathedral there are two small and carefully executed caterpillars on oak leaves, and on another, squirrels partially hidden among hazel nuts and foliage. Bosses from other cathedrals show several kinds of fruit not found, so far as I know, on capitals or anywhere else, except on the roof : for example, the globular fruits of the yellow water-lily and open pods disclosing a row of seeds associated with leaves like those of a bean. The

postcards on sale in Norwich Cathedral, showing the details of bosses on the unusually high roof, are striking examples of Mr. Cave's work.

The naturalistic treatment of plants is a recurrent phase of art: the vine-leaf frieze on the famous Alexander sarcophagus (B.C. 350) in the Constantinople Museum is both beautiful and realistic. In Greek, Roman, and Byzantine buildings acanthus leaves are often faithfully reproduced, but it is none the less true that it is possible to trace the acanthus *motif* through varying phases, some of which suggest a transition to vine leaves associated with clusters of grapes. Some of the more conventional patterns characteristic of classical architecture have not been satisfactorily traced to their origins, and there is still much to be done in following more closely the evolution of Greek patterns from Egyptian and other sources. The Papyrus (*Cyperus Papyrus*) and Lotus (two species of *Nymphæa*) of the early Egyptian half-reliefs are not only attractive but they have a botanical significance as records of the former abundance of plants in places where they are now extinct. It is legitimate to speak of a naturalistic period in Cretan art, *e.g.*, from B.C. 1700 to 1500, when, in addition to native species—irises and lilies, etc.—the papyrus and date palm were more conventionally represented, in all probability because they were not native but derived from Egypt. In this connection it is worth mentioning that a block of volcanic ash from Crete, recently sent to the Cambridge Geological Museum, has on it a clearly defined impression of a palm leaf, probably *Chamærops*, the only living European palm, which shows that at no distant date, in a geological sense, palms grew in the island.

Allusion may be made to another line of enquiry which may throw light on the evolution of ornament from plant forms, namely a study of certain types of sculptural decoration, such as the 13th-century three-lobed "leaf" and the 14th-century ball-flower, both characteristic of English Gothic; the former almost exclusively English and the latter unknown on the continent. As seen in the example of a three-lobed leaf or "stiff leaf" ornament, as it is less appropriately called, shown in the illustration on p. 134 (one of an admirable series of photographs of details in Lincoln Cathedral, taken by Mr. S. Smith, of the Minster Bookshop), a characteristic feature is the prominent rib running up the middle of the central lobe. The rib often ends abruptly a short distance from the leaf margin, and not infrequently penetrates the leaf substance; in some examples the rib is replaced by a deep groove or by an actual space, which may be derived from a looped strap such as occurs in Anglo-Saxon decoration. We still lack a satisfying explanation of the different forms of the trilobed *motif*, some of which are illustrated in Mr. Samuel Gardner's attractive book mentioned below. The ball-flower is common in 14th-century churches, especially in the west country, though it is not confined to one district and occasionally occurs in East Anglia. It looks like a spherical bud with three gaping scale-leaves surrounding a raised boss in the centre and at a slightly lower level; comparison may also be made with a partially opened fruit, such as a horse-chestnut. The origin of this English ornament is still an unsolved problem, and a fuller consideration of the trefoil and ball-flower must be postponed.

My primary object in giving these brief descriptions is to indicate that a comparative study of plant forms in architecture, both naturalistic and stylised in different degrees, from the earliest time to the end of the Gothic period offers a promising field to botanists desiring a change from a more exact branch of scientific research.

REFERENCES.

*English Gothic Foliage Sculpture*, by S. GARDNER: Cambridge Univ. Press, 1927.

*Nature in Design—a Study of Naturalism in Decorative Art from the Bronze Age to the Renaissance*, by JOAN EVANS: Oxford Univ. Press, 1933.

*The Medieval Carver*, by M. D. ANDERSON: Cambridge Univ. Press, 1935.

## Excavations in Persia

Important Discoveries at Persepolis during the current season are announced by the Oriental Institute of Chicago, which has an expedition at work on this site. In the audience hall of the palace solid gold and silver plaques have been found, which had served as foundation deposits. They are thought to be contemporary with Darius and to date from about 515 B.C. A series of inscriptions, also believed to be foundation deposits, have been found in what were apparently the garrison quarters. One of these records a hitherto unknown and unsuccessful rising of the priests of the ancient deities at the time of the accession of Xerxes. This rising was directed against Zoroastrianism, the priests of which had gained ascendancy in the previous reign of Darius, the father of Xerxes. The most important inscription, however, from the point of view of the historian, is the first official record known of the extent of the Persian Empire under Xerxes, shortly before 480 B.C. It lays claim to a dominion extending from the modern Afghanistan and beyond the Indus, to Asia Minor and to Egypt and Punt. It also includes part of Greece, mentioning "the Ionians who dwell in the sea and those who dwell beyond the sea".

# Iceland and her Rivers.

**By R. Ansell Wells.**

*Iceland, with its ice-bound interior, depends for its very existence as a human habitation on the rivers that have created the soil of its lowlands and are the home of trout and salmon—a major source of the island's wealth. The theme of our article is the rivers, and what is happening to them to-day—a fascinating sidelight on a little-known land.*

Leiþ erumk fjöll, vaska þar lengi á,
nætr einar niu ;
ulfa þytr þóttumk illr vesa
hjá sôngvi svana.
(*Snorra Edda.*)

[Hateful the Hills ! though not long I lingered,
nights only nine I dwelt there ;
the howling of wolves was ill, meseemed,
beside the song of the swans.]

THESE words of the god Njörd of Nóatún, handed down through the ages from the world of mythology, give as true a picture as ever they did of the attitude of the lowlander towards the highlands of his own country. Nevertheless, the lowlander cannot live without the highlands which he so decries ; he is dependent upon them to a greater extent than he is probably prepared to admit, and, indeed, had it not been for the highlands, in Iceland at any rate, there never would have been any fertile plains.

The natural connecting links, the arteries that feed the lowlands, are the rivers rising far up in the highlands. The purpose of this article is an attempt to outline the part which the rivers of Iceland have played in the formation of the country, and the part they are playing in the lives of its inhabitants. A very brief outline of the main geological features of the country is necessary to form the stage upon which we are to see the rivers as the principal players.

The high lands of the interior are built up of basalt, formed during a late period of the world's history. At this epoch a long succession of volcanic eruptions piled up layer upon layer of this basalt so that the aggregate thickness of the strata is now about 3,000 feet. In the south and the adjoining parts of the midland districts where the volcanic activity, although lessening in degree, is still active, there are, besides the basaltic layers, clastic materials in great quantities : tuffs, breccias, and conglomerates formed of volcanic ashes, pumice stone, moraines, riverine deposits and the débris swept down by the *jökull-hlaup* (glacier bursts or sub-glacial eruptions). The surface of these districts, unlike that formed by the simple basalt layers, has altered much since the Ice Age. The strata of which they are composed are soft, and prone to the action of the erosive agencies of air and water, while ever-recurring volcanic eruptions have spread sheets of lava over great parts of them.

*Skógafoss, though not very large for Iceland, is a very beautiful waterfall over* 180 *ft. in height.*

Except in these parts the surface of the land has altered but little through the ages, and the interior is to-day the same vast, inhospitable region which it has been throughout time. Since the days of the greatest development of the Glacial Period the Ice Cap has retreated, until now it covers an area of 13 per cent. of the whole country, or rather over 5,500 square miles.

Immediately below the Ice Cap there is little or no soil at all. Below this district, again, there is assuredly soil of a kind, but in this cold climate where the temperature has permitted

decomposition to play only a very insignificant part in the shaping of the surface features of the land, this soil is chiefly formed of glacier detritus, volcanic ashes, and earth carried by the wind. These substances, being of light weight and of a loose nature, form a fairly satisfactory covering to the rock in sheltered districts, but in exposed places or where the sward is broken up, the soil, when in a dry state, is apt to be blown away.

From the Ice Cap, those regions of perpetual snow and ice, flow the larger rivers, and a study of the map will show how, in the course of centuries, they have carried down large quantities of gravel and sand, with which the heads of the fjords have become silted up. Low plains have been formed, which constitute the main portion of the irrigated and marshy meadows in Iceland. So we see that it is the rivers that have been responsible for the formation of that part of the land which can be considered really satisfactory for the support of a population and for the pursuit of agriculture.

The most important glacier rivers that have done the major part of this work are nine in number. Þjórsá, the Southern Hvítá, the Western Hvítá, Blandá, Hjeraðsvötn, Skjálfandafljót, Jökulsá á Fjöllum, Jökulsá á Brú, and Lagarfljót. The largest is Þjórsá, with a length of 137½ miles from its source in Hofsjökull to the sea on the south coast, and an estimated horse power of 940,000. Next in point of length are Skjálfandafljót and Jökulsá á Fjöllum, which have their sources in Vatnajökull and flow into the Arctic Ocean.

*Goðafoss, the third largest waterfall in Iceland.*

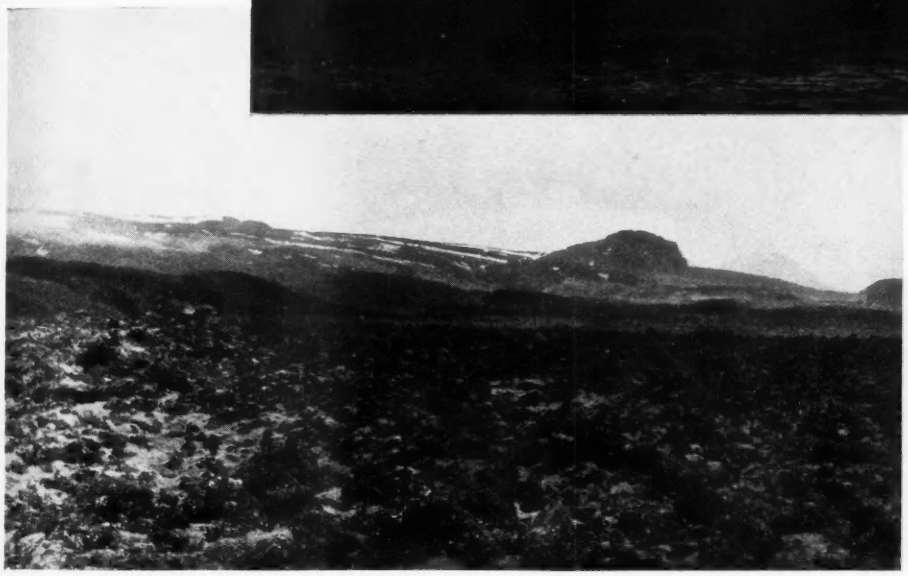
These rivers and others like them are the gigantic forces which have worked to build up the country, but to-day they do not play such an important part. True, their power is enormous, but it is too large; there is never likely to be any great use for it in a country so sparsely populated. The rivers which are now so vital to the well-being of the inhabitants are the smaller streams found everywhere round the coasts. Everywhere, the life of the community is dependent on these rivers; they irrigate the short stretches of the plain which provide food for the beasts, and with their fish they provide a valuable item of food for the people.

The most prosperous parts of Iceland are undoubtedly the west and north coasts; in consequence, the commercial activities are for the most part on these coasts and centre on the capital, Reykjavík, which lies on the Faxafloi in the south-west corner. The east coast districts are very remote, and, owing to their mountainous nature, the pasture land is somewhat circumscribed. The south coast lies in close proximity to the Ice Cap—indeed, in some places the ice sweeps down to the sea—with the result that the eastern part of this coast is very barren, consisting chiefly of loose earth and stones washed down by the short, rapid streams from the Ice Cap. Only a short stretch west of Eyjafjallajökull is suitable for agriculture. Here the two great rivers, Þjórsá and the Southern Hvítá, have built up a very fertile region between the mountains on the east and the lava wastes of the Gullbringusysla on the west.

The valley of the Western Hvítá—the Borgarfjörður district—is, perhaps, the most fertile in Iceland. Running north-west from the head of this valley is a heathy ridge, the western end of which is known as Tvidægra, while farther up it is called Arnavatnsheiði. Throughout its length are very many small lakes; the rivers rising here, particularly those on the southern and western sides of the watershed, are very well suited to the requirements of salmon, including in their number such well-known names as Norðurá and Þverá. This latter has achieved for itself the biggest reputation of any river in Iceland. Probably on account of its fairly close proximity to Reykjavík it is well known for the excellence of the sport it affords and for the numbers of fish it yields annually to both rod and line fishermen, and in the nets.

The reputation of Þverá has somewhat obscured that of other rivers no less worthy of note: in the opinion of the author, Laxá, from Myvatn, is peerless. The source of this fine river, Lake Myvatn, is situated on the

*Below: a typical field of post-glacial lava extending to an area of about 5 sq. miles.*



*Above: Vatnajökull (Southern Ice Cap) from Hornafjörður, showing the ice outfall reaching down to sea-level. Here Tryggvi Magnusson's expedition began its ascent to the Ice Cap.*

edge of the lava wilderness of Odáðahraun, where it is something in the nature of a surprise to find so beautiful a place on the edge of over 2,000 square miles of black desolation. This lake, with innumerable small bays and studded with islands, is the breeding ground of many different varieties of duck, and likewise affords excellent trout fishing. The river Laxá, flowing from it into the bay of Skjálfandi, on the north coast, is a very fine trout stream throughout, though, from the point of view of the rod and line angler, essentially an early river, as about the middle of July the weed which grows there begins to break off, and it is no uncommon occurrence to see the surface of the water entirely covered with floating pieces. Salmon penetrate Laxá but are prevented from getting the whole way up the river by the falls, Brúarfoss; about half a mile short of this point they turn up the tributary, Eyvindarlækur, into Múlavatn, from where they go into Reykjardalsá to spawn. It is a very curious fact that only very occasionally have salmon ever been found between the junction of Laxá and Eyvindarlækur, and Brúarfoss. This whole system affords magnificent fishing in beautiful surroundings and conditions in it are so good that there is practically no limit to the number of fish it will support.

Another excellent river, also on the north coast, is the glacier river Blandá, with its tributary, Svartá. Years ago this system was among the best in Iceland, but in the last twenty years or so excessive catching did much to harm the water and its stock diminished very rapidly. Now, however, these waters are again in good hands; they are being stocked and may shortly be expected to regain their former high standard. This is an instance of the present wise and far-seeing policy of the Icelandic Government, who, by a strengthening of their Freshwater Fishery Laws and by the introduction of local bye-laws where necessary, are taking big steps to prevent the harmful exploitation of rivers and doing a great deal to encourage all forms of fish-preservation and fish-rearing. The rivers and the fishing rights

belong to the riparian owners, and it is no longer legal to sell them away from the land. Thus, it is the more illiterate members of the community upon whom the responsibility for the rivers devolves. The abuses prevalent in the past were the outcome of ignorance, or rather, of the lack of knowledge. These riparian dwellers are the descendants of the first settlers of Iceland, who began to come there from Norway in the year A.D. 871. At that time Harald Fairhair was subjecting the whole of the latter country to his rule ; those petty chieftains who were too proud to bow before him had to choose between death or

*Önundarfjörður. This curious coastal formation occurs in Iceland only on the north-east coast.*

departure. For many of them, who dwelt along the coastal districts, the sea had no terrors. They were the men who, packing up their moveable possessions and their families, sailed away for unknown lands of which they had heard tell, or which perhaps a few of them had seen when tempests had driven them far out of their course on a viking expedition. These were the first settlers in Iceland and their methods of sea-fishing they applied to the rivers, a traditional practice that has unfortunately survived until the present time.

The rivers in these northern latitudes have not, with few exceptions, the food resources of those farther south (in Scotland, etc.), with the result that they cannot support such large stocks of fish. Such stocks as they can support have in the past been very severely depleted by the wholesale methods of catching employed on them. In fact, many rivers have ceased to contain salmon at all, as can be seen from the number that were called Laxá (Salmon River) by the early settlers and in which no salmon have been seen for many years.

The only really satisfactory method of correcting this state of affairs is by education. The government have realised this, and they are now concentrating on getting the riparian owners on each river to form an association for the river. Such an association elects a governing committee which is then able to control the river as a whole : the netting and angling activities are kept within bounds and it is possible to make arrangements for stocking such rivers as may need it from time to time. Another instance of this wise policy is the river Vididalsá, which is now being taken in hand. For some years there has been excessive netting in the Hóp, the salt-water lake at the mouth of the river, with the result that there have been no fish in the river at all. From 1936 there is to be no netting in the estuary, so it is reasonable to suppose that the numbers of fish which have been taken there in previous years will now go up the river, where catching is also to be restricted. Allowing five years as the "Salmon Cycle," 1941 should see this river in very good order.

The government, following up their programme for the improvement of the rivers, have appointed a fully qualified expert. This man, an Icelander, has had three years' training in Germany and Denmark and is to go out to Iceland this year and take control of the biological side of the question. He will be in control of all the Freshwater Fisheries in the country and will have under his direction the government's hatcheries.

These hatcheries, which have been instituted on co-operative lines, are supported by those farmers all over the country who have an interest in any river or rivers suitable for fish. They also receive a government grant, and will, as they become established and increase in efficiency, largely take over the work handled till now by smaller hatcheries which have been in existence on various rivers, and have been run on more or less efficient lines, but without any definite plan of co-operation. The two government hatcheries, when they become established, will enter actively upon working up the stocks in those rivers which are most suitable for commercial fishing. They will also try and establish fish in rivers which are thought to be suited to their requirements, but where, from one cause or another, there are no fish at present.

These thorough and carefully thought out measures

will have a tremendous effect on the fishing. At present some of the rivers are among the finest in Europe, and can be rented very reasonably as compared with those in other countries. If they were to receive the attention they deserve from English rod and line fishermen it would be of great benefit to Iceland. In the past Englishmen have rented rivers in Iceland, and have fished them in a sporting manner and exercised a certain amount of protection ; these rivers are now among the best in the country.

The next ten years will be a period of steady and continuous improvement in the quality of the fishing and, as it becomes more widely known, in the prices which it will command. This improvement will be of all-round benefit to the agricultural community. The increase in the supply of fish will provide all that is required for food and a surplus which can be sold for export. The rents paid by foreign sportsmen go into the pockets of the farmers. In a country such as this, where agriculture affords only a comparatively small return for a lifetime of work, the money obtained in this way makes a big difference to the year's income, forming, as it does, a source of revenue, the exploitation of which does not involve the neglect of other duties.

The rivers created the habitable part of Iceland. Their excellence made it possible for the early settlers to support themselves and their families while they established the foundations of agriculture. Their continued productiveness will provide in Iceland that extra assistance of which agriculture all over the world is in such pressing need at the present time.

# Everest : the Fifth Assault.

**By Arthur Harris.**

Once again Mount Everest is being attacked, and within the next six or seven weeks we shall know whether the citadel has fallen or won another respite. Whatever the news, we can no longer doubt that the mountain is doomed ultimately to be conquered, unless the Tibetans withhold permission for any further attempts. Each expedition, though none has been successful, has provided added experience for the profit of the next. The climbers have become more sure of their ability to withstand high altitudes ; the porters have climbed higher and increase in keenness every time. The element of the unknown has diminished.

Leaving out of our calculations all consideration of the weather we can feel confident that the 1936 expedition led by Mr. Hugh Ruttledge has a better chance of success than any that has made the attempt in the past. In Frank Smythe, Eric Shipton, and Wyn Harris the leader has three brilliant climbers, each of whom has reached a height of 28,100 ft. on Everest without oxygen. Kempson, Wigram, and Warren were with Shipton on his reconnaissance expedition last year ; Oliver, though new to Everest, made the second ascent of Trisul three years ago ; Gavin, lacking experience of the Himalayas, has yet an excellent Alpine reputation.

Faults in the 1933 equipment revealed by the supreme Everest test as, for instance, unsuitability of tent material, through which high winds drove fine snow, have been rectified. Stoves and sleeping bags are more efficient, and greater care than ever has been exercised in the choice of food, individual tastes of the climbers being specially catered for. No previous expedition has been so well found.

Base camp will, as before, be established in the Rongbuk Valley at 16,800 ft., and owing to lack of snow the expedition has been able to take a shorter route thither than that of 1933, over the Seba La and Kongra La instead of over the Natu La and along the Chumbi valley.

From base camp, the route lies along a glacier shelf round into the Valley of the East Rongbuk Glacier to Camp I (17,800 ft.), a distance of some 4½ miles. Camp II is about three miles further on, on the other side of the valley. Up to this point the way is rough but technically easy, though on the latter stage it is already necessary to choose carefully a path suitable for the porters. The next stage lies through a tangle of seracs calling for a certain amount of axe work in difficult places before flat glacier, and, eventually, Camp III (21,000 ft.) are reached.

From Camp III to Camp IV is a laborious journey up the slopes of the Chang La or North Col. How difficult these slopes will be is uncertain for, composed of ever-shifting ice and snow, they vary in pattern from year to year. In 1933 it took the climbers a week to cover this stage, although a buttress of snow left by an old avalanche assisted to some extent in the task of surmounting the 40-ft. high ice wall which stretches across the slopes. In September, 1921, Mallory, Buller, and Wheeler went straight up without any difficulty, except at one steep place where they had

to plough 500 steps. The Col has never since been reached with such ease. Camp IV was pitched, in 1933, in an exposed position on the summit of the Col, a more sheltered site just below the summit being found uncomfortably exposed to bombardment by small avalanches.

The next stage, up the North Ridge, is not very difficult technically but is, nevertheless, heavy going. In 1933, Camp V was at 25,500 ft., and Camp VI, the highest, at the top of the Ridge at 27,400 ft. This year it is planned to pitch Camp VI at some point rather lower, and to establish a seventh camp higher up.

There are two routes from the summit of the North Ridge. One is by way of the skyline, but this involves the ascent of the Second Step, one of two sheer-faced interruptions to the sloping ascent of the ridge, which Wyn Harris and Wager examined in 1933 and found

*A view of Mount Everest from the base camp at the head of the Rongbuk Valley, 16,800 feet.*

[*Photograph by courtesy of the Royal Geographical Society.*

impossible, so this may be counted out. The other consists of a traverse horizontally across the face to a point beyond a great couloir or gully, whence a subsidiary gully runs up and through the great wall of rock that otherwise bars the way to the final pyramid. The later part of this traverse is over steeply sloping slabs of rock, arranged "like the tiles on the roof of a house," so that there is very little purchase for hand or boot. This was the route traversed by Norton and Somervell in 1924, and by Smythe in 1933. Wynn Harris and Wager also reached the subsidiary gully in 1933, but all these were held up at approximately the same point, 400 feet below the base of the final pyramid and 1,000 feet below the summit.

This year, a Camp VII, pitched probably somewhere below the Second Step, will enable those engaged on the final assault to reach the subsidiary couloir earlier and increase their chances of achieving their ultimate object in time to return safely. If it proved possible to establish yet another camp at the top of this couloir it would do something, in the event of success, to minimise the danger of the return by tired men. Much depends on the condition of the two couloirs. Smythe was turned back in 1933 by the new-fallen snow in the second, which was soft and loose and incapable of holding the foot. The nature of the snow here depends on the weather, and it is the weather which will in this year, as in 1933, prove the deciding factor rather than the effect of altitude on the climbers.

As long as the strong west winds prevail they check the dangerous sprinkling of snow over the "roof tile" slabs and its collection in the second couloir, but when these winds grow weaker the snow wins its tussle with the wind, making further climbing progress impossible. Judging by the experience of the previous expeditions these monsoon conditions will set in at some time between the end of May and the middle of June. The later they come, the greater chance is there of success for the climbers. The weather in 1933 was bad. The Alipore Observatory reassuringly promises that this year it will be better. But Everest's own weather is not always what is expected, and precious pre-monsoon days may be wasted owing to sudden terrific storms.

Whatever difficulties may be presented by the final pyramid are still hidden. Norton thinks that there would be no further difficulty and that a fit party could reach the summit at a rate of 200 to 250 ft. per hour. Smythe puts the rate at a little over 200 ft. but thinks the going may be exhausting owing to the broken nature of the surface, although he does not expect there would be any difficulty until the summit ridge is reached, when cornices might be met with. Progress up the pyramid could probably be accelerated if the oxygen apparatus is brought into use. It was never used in 1933, though available, but two types have been taken out this year. One of these delivers a mixture of oxygen and atmospheric air, and weighs 25 lb. The other delivers undiluted oxygen and weighs 35 lb. Wyn Harris has suggested that such apparatus might well be used for the arduous ascent of the second couloir and then discarded until the return, when any that was left would give added strength for the remainder of the descent to Camp VII. If it is found necessary to use either type of apparatus an uncertainty will be introduced second only to that regarding the weather. Against these uncertain factors we have the certainty that climbers and high-altitude porters will do whatever is possible. If the weather is kind and the oxygen apparatus satisfactory if used, they should succeed.

# The Nightingale in Devon.

By E. W. Hendy.

*England and Wales are the northern limit of the nightingale's range. Until recently the species was uncommon in Devon, but careful investigation has shown that it is increasing in numbers there and extending its breeding habitat westward.*

In D'Urban and Matthew's *The Birds of Devon*, published in 1895, it is stated that the nightingale (*Luscinia m. megarhyncha*) is a summer migrant of occasional occurrence in the southern part of the county, and that it breeds occasionally. The authors give records of its occurrence from 1844 to 1890: most of these are in East Devon and the Exe Valley, but there are a few from the Teign and Dart Valleys, and the south Devon coast: the records furthest west are one at Horrabridge, on the Meavy (which eventually flows into Plymouth Sound), and another at Torcross in Start Bay on the south Devon coast. There is also one from Barnstaple on the north coast. Many of these reports appear to be unsubstantiated, and are so meagre for a period of nearly fifty years, that it is obvious nightingales were at that time a rarity in Devon. The only records given of nesting are one near Exeter in 1872, and "several pairs" near Ashburton in 1888 and 1889. The authors add that though the range of the species seems to be extending westward, it has not yet been recorded from any place west of the Tamar, *i.e.*, in Cornwall.

## Misleading Information

Most writers on British birds show a discreet and studied vagueness as to the south-western range of the nightingale. Newton's *Dictionary of Birds* says that the western limit seems to be formed by the valley of the Exe, which is only overstepped on rare occasions. Montagu's *Ornithological Dictionary* states "certainly not farther west than the eastern borders of Devonshire," and refers to the legend that the nightingale may only be found where cowslips grow plentifully. The Report of the Committee of the British Ornithologists' Club on the immigration of summer residents in 1913, Vol. XXXIV (the last Report published), gives only one record for Devon, apparently in the east of the county. One bird book, published as recently as 1931, still has it that this species does not occur in Devon, and another, dated 1934, calls it scarce in south-west England. Mr. Witherby's *Practical Handbook of British Birds* (1920) states that in Devon it is confined to river valleys a short distance inland from the south coast as far west as the Dart: even this pronouncement is no longer quite accurate.

The discovery that the nightingale is to-day a fairly common species in certain districts of Devon, and that it has been and is still extending its range westward, is due to the investigations carried out over a series of years by Messrs. A. H. Rousham and A. O. Rowden of Exeter. The results of their researches have been published by them in the Reports of the Devon Birdwatching and Preservation Society, and I have also to acknowledge their courtesy in allowing me access to their notes, without which this summary could not have been written.

## The Westward Advance

Mr. Rousham, in a paper contained in the third Report (1931) of the Devon Birdwatching and Preservation Society (reprinted from the Transactions of the Devonshire Association), supplements the records quoted in D'Urban and Matthew by others from the notes of the late Dr. E. A. S. Elliott, to which he has had access. Dr. Elliott found many unverified reports, but there were authentic records of the nesting of the nightingale at Bovey Tracey in 1898 and 1899, at Trusham, in the Teign Valley, in 1899, 1902, and 1903, and at Coombe Raleigh, East Devon, in 1897 and 1899.

Mr. Rousham began personal investigations in 1900. From 1900 to 1905 nightingales were heard and seen at Broadclyst, five miles north-east of Exeter. His first nest was found on the Exeter Canal bank in 1906. From 1907 to 1910 several birds were reported from various places a few miles north or east of Exeter, and in 1907 a nest was found at Cowley, one mile from the city. In 1912 an exceptional number of nightingales was reported, and seven were authenticated, all again within a few miles north or east of Exeter. In 1913 four were reported and one nest found, and in that year, and also in 1914, there was a record from Whitestone, four miles west of Exeter. The years 1917-18 produced further records from the Exeter district, and in 1918 there was a report from Bridford, in the Teign Valley, six miles south-west of Exeter. In 1921 and 1922 more nightingales were located near Exeter, and in 1921 one at Branscombe, east Devon, and at Shaldon at the mouth of the Teign fifteen miles south of Exeter. From 1923 to 1927 reports from various parts of the country were recorded: they were not personally verified by Mr. Rousham, but he has no reason to doubt their accuracy. Mr. Rowden states that nightingales were constantly breeding in Stoke Woods, near Exeter,

during this period. In 1928 there was another report from Clyst St. George, south-east of Exeter, and two pairs and a nest were found at Newton Abbot on the Teign, 17 miles south-south-west of that city.

In 1929 Mr. Rousham was joined by Mr. A. O. Rowden; they planned an intensive search which resulted in their tracing eleven pairs in 1929 and thirty-four in 1930. Of the 1929 pairs several were north and east of Exeter, but the rest were in the Teign Valley, the farthest west being at Heathfield, ten miles south south-west of Exeter. The records in 1930 were more widely distributed: there was again a good number north and east of Exeter, one near Starcross on the Exeter Estuary, considerably more from places in or near the Teign Valley, and one from Bovey Tracey, on the Bovey, a tributary of the Teign. There was also evidence of nightingales spreading westward; they were reported at Salcombe, on the south Devon coast, at Aveton Gifford on the Avon, and at Spreyton, north of Dartmoor. Spreyton is the farthest west of these, being situated about 15 miles almost due west of Exeter. But a nightingale recorded the same year at Northam near Bideford, near the north Devon coast, is about 16 miles farther west than Spreyton.

*Hen nightingale on nest.*

In 1931 Messrs. Rousham and Rowden heard 51 Devon nightingales and had sufficient evidence of several others, making altogether 61 birds, and most of them paired. Many of these were in the Teign Valley: on April 29th 22 were heard singing in the district round Chudleigh Knighton. More attention also was given to the district east of Exeter, and nightingales were found as far east as Chardstock and Axminster. The farthest west this year was at Kingsbridge on the Avon, practically as far west as Salcombe, where one was recorded in 1930. One was heard at Venn Cross, near the River Batherm, an easterly tributary of the Exe, near the Devon and Somerset border, 23 miles north-north-west of Exeter.

In 1932 the investigators recorded 45 nightingales in Devon. The farthest west was at Hatherleigh, near the source of the Torridge, north of Dartmoor: this was farther west than the Kingsbridge nightingale in 1931, but not so far west as the Northam bird in 1930. There were no nightingales at Kingsbridge in 1932. A new locality was Lapford, on the upper Taw, north of Dartmoor. Bad weather at the beginning of the season prevented a full investigation: it is believed that but for this the 1931 total of 61 would have been exceeded. The Bovey Lake district, in the Teign Valley, as in 1930 and 1931, was much favoured and there were again a good many records from the Exeter district and east Devon. A number of other reports of nightingales was received from various parts of the county, but except as above mentioned none of these was substantiated.

The survey of Devon nightingales in 1933 was valuable as well as interesting, because 50 per cent. of the records were from districts where the bird had not previously been discovered. Their breeding area was extending still farther westward and northward, for authentic reports came again from Northam, and also from Instow, on the opposite bank of the Torridge. There were new records also at Coldridge and Eggesford in the Taw Valley, Morchard Road on the Yeo, a tributary of the Taw, and from Yeoford, west of Crediton, all of which show an advance to the north-west from Exeter. Another new nightingale district was discovered at Cullompton, 13 miles north-east of Exeter, and new birds were reported at Washfield, Oakford, and Rackenford in or near the Exe Valley, between 15 and 20 miles north of Exeter. There were again reports at Salcombe, Axminster, Chardstock, and in the Exeter and Exmouth districts. In the Teign Valley near Chudleigh Knighton 15 were identified, though the district was visited only twice: there was also a record from Teignmouth. Altogether 48 nightingales were traced in 1933.

In 1934 it was found impossible to carry out an intensive search, but 42 nightingales were located, many in their usual haunts in the Teign Valley, in the Exeter

and Exmouth districts, near Chardstock, and in the Sidmouth neighbourhood, but several in new localities. The farthest west heard during the breeding season was one at Hatherleigh, on May 31st, and another at Winkleigh, a few miles east of Hatherleigh, on the same date. One was reported in Central Park, Plymouth, on August 31st, a position as far west within a few miles as the Northam record in 1930, but at that date the bird could not be breeding and was probably on return migration. In 1935 an exhaustive search was not feasible, but 51 nightingales were marked down in Devon. Of these over 30 were in the Teign Valley district, near Chudleigh Knighton : six were in Stoke Woods, near Exeter, four more in the Exe Valley and eleven in east Devon. The farthest west were those near Chudleigh Knighton.

*Cock nightingale offering food to his mate.*

Altogether, since 1906, 346 definite records of nightingales have have been obtained in Devon. The most intensive investigations were carried out from 1930 to 1932. Messrs. Rousham and Rowden consider the Bovey Lake district, comprising the area of claypits between Kingsteignton and Chudleigh Knighton, to be the great metropolis of breeding nightingales in Devon. They find that nests are built year after year within a few yards of the same spot ; I have noticed the same in west Somerset. The question whether the same birds or their offspring return to the same territory can be proved only by ringing.

*A Devon nightingale's nest.*

[*Photo : A. E. Rowden.*

In 1932, at the request of the investigators, the Devon Birdwatching and Preservation Society circularised all the Police Constabularies in the county and asked them to report any birds singing at night. The results proved most valuable : 21 songsters were reported, and of these twelve were nightingales. This assistance was continued in 1933 and 1934.

Mr. Rowden is convinced that the scarcity of reports in the past was due chiefly to lack of observers. In conversation with old inhabitants, when listening to a nightingale, he has been assured that they have heard the bird every summer for years past, but it has never occurred to them that it was anything unusual. He adds that he found the most successful method of tracking nightingales was to whistle the opening notes of the song at a likely spot in broad daylight. Time and again the immediate response was a full burst of song.

With regard to the routes taken by the nightingale in reaching and after arrival in Devon, Mr. Rousham, in his paper (mentioned above), writes as follows :— " The nightingales appear to cross into England from France by the narrowest parts, arriving first in Kent, Sussex, and probably Hants. They then spread north, north-west, and west, fanwise, distributing themselves

over the area covered. By the time Devon and other parts of the outer fringe have been reached, most of the birds have settled down, and only a comparative few ever reach our county." In the same paper Mr. Rousham states that, following their westward journey, nightingales are recorded from various places in east Devon and the Exeter district. At Whitestone, four miles due west of Exeter, they appear soon to strike the Valley of the River Teign, and then to follow it to its mouth, settling down at various places along its course.

The B.O.C. Committee's Report cited above (the last one issued) states that in 1913 nightingales arrived on the southern and south-eastern coasts from Dorsetshire to Suffolk. Dr. Eagle Clarke in his *Studies in Bird-Migration* (Vol. I, p. 314) mentions one killed at the Eddystone Lighthouse during a rush of migrants, April 12th, 1902; this seems to be the only record from the Eddystone. Mr. Rowden's opinion is that nightingales cross on a front extending at least as far west as Plymouth. He has earlier records from the Kingsteignton district, of birds migrating *up* the Teign Valley, than from Stoke Woods, near Exeter, where he is certain that he has recorded nightingales on the day of their arrival. In some years mightingales appear in west Somerset at practically the same date as in the Teign Valley; this appears from my own notes.

### The Search for new Nesting Sites.

Mr. Rousham attributes this spread of nightingales to, and increase in Devon, to the motor car and the invasion of the countryside, especially in the Eastern and Home Counties, by "building development," which involves the destruction of former nesting sites. My own observations in west Somerset point to a similar conclusion. In 1929 a nightingale nested near Porlock for the first time, so far as I am aware, and every year since, nightingales have visited this district, and on at least three other occasions have nested. This locality is six miles farther west than their previous breeding haunts in west Somerset. The statement in Mr. Witherby's *Practical Handbook* that the nightingale is absent in extreme west Somerset is no longer accurate.

It is obvious from the facts recounted above that, though it has not been possible to carry out an intensive investigation since 1932, the nightingale has, at least since 1929, nested in considerable numbers in east Devon, the Exeter and Exe Valley, and Teign Valley neighbourhoods. It has also extended its breeding range in north Devon, along the northern side of Dartmoor (and in west Somerset). It is probable that in the future its breeding range may advance still farther westward. So far there is no authentic record of a nightingale having nested in Cornwall.

## Some Uses of the Photocell.

Three interesting papers on the application of photo-electric cells were read at a meeting of the Illuminating Engineering Society on April 8th.

Mr. R. C. Walker, after briefly describing the various types of light-sensitive cells, dealt with their applications. He pointed out that the problems to which it is intended to apply them are often not photo-electric problems, but optical, electrical, or mechanical. For acoustic reproduction, photo-electric cells are used in connection with warnings of the opening and closing of lift gates. They will also be used for the new service on automatic telephone exchanges for announcing the correct time. Possibly the greatest demands are made on photocells in television transmission, whilst they are used also in still picture transmission by wire or radio. In the industrial field photocells are employed in the counting of objects, such as cigarettes, passing along a conveyor. In paper-making and associated industries the photocell is used for giving warning when the web fractures on high-speed paper-making and printing machines; for controlling the process of re-reeling; for securing correct register in double printing processes; and for counting newspapers or printed matter. Other uses described were for burglar-alarms, smoke detection in factory chimneys, the control of advertising signs, the regulation of the speed of escalators, and the timing of sporting events.

Mr. L. H. McDermott, of the National Physical Laboratory, described three distinct ways in which photocells have been used in connection with problems of daylight illumination. The first was a photo-electric relay control for the lighting of part of the National Portrait Gallery. The second was in connection with a device for the continuous recording of the amount of daylight illumination under varying weather conditions at Teddington; and the third was in the investigation now being carried out by the National Physical Laboratory into the lowest value of natural illumination which an office worker requires.

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(*Continued from the next page*)

the best results are obtained with the teacher's familiar voice as narrator. With backward children remarkable instances of progress have been recorded. The future for the classroom film is hopeful, if teachers would learn the use of it as a new type of tool and employ it with a breadth of purpose analogous to that of certain other modern institutions. They should bear in mind that the tricks of the new medium are novel and have to be learned with an open mind.

# The Classroom Film.

**By L. E. C. Hughes, Ph.D.**

THE publication of three more books* on educational films, this time particularly on those useful in the classroom, brings forward again the general question of the documentary film, a department in which we may be proud to say that this country leads the world, judging from the awards at the recent International Exhibition at Brussels.

The way in which " documentary " arose is interesting. According to some sociologists, liberal education is failing to respond to modern needs for two basic reasons. Firstly, because any youthful spirit on the part of teachers is reminiscent of their own youth, a generation or more ago, when the world was different and thought differently ; and secondly, on account of the difficulty in introducing sufficiently broad experiences to the rising generation to illustrate the fundamental principles that teachers presumably have in mind when moulding the outlook, character, mind, and hands of their pupils. Experience in America shows that a measure of uniformity of spirit, the essential " Americanism," is induced into a wide diversity of types, immigrated from odd quarters of the earth, in the course of not more than a generation. This has been traced very largely to the American press, which, by psychological pressure, moulds varied characters into the composite American we know so well. Unfortunately, newspapers are vested interests, and in their commercial world there is scant possibility of using their wide circulation for purposeful cultural ends ; that they have wielded this great influence in America is accidental, but in so doing they have revealed their power.

## Emotional Appeal.

If such can be done with words on paper, what more can be done with the greater power of the cinema, in which the combined visual and aural impressions have a greater emotional appeal than any other medium used hitherto ? The point is, the film also failed to be a cultural power in the community, at least in any educational sense. Analysis shows the great proportion of film themes to be degrading : actions depicted are immoral in the widest sense, and the characters illustrated are of little importance in the world, even when their occupations are in evidence. To reverse this purposeless and idle use of the cinema, John Grierson evolved the documentary film. He saw that by getting out of the studio to the places where real people are doing things that matter, and by bringing impressions back to the observer, the experience of the latter is widened in ways hitherto unknown. By definition, documentary is the " creative treatment of actuality " ; it is the dramatisation of things that are, using normal people at their normal occupations, as the characters-in-chief.

## An Accidental Discovery.

It appears that documentary entered the cinema almost by accident, the epoch being marked by the acceptance by the public of " Drifters," a herring fishing film, conspicuous among a number made by Grierson and his group for the now defunct Empire Marketing Board. Now transferred to the Post Office, the group carries on the good work, spreading it not only through normal cinema channels, but also among new audiences—members of clubs, etc.—to the extent of several millions per year, and this at no great cost.

The classroom film is the little brother of the formal documentary, and special care is necessary in its handling if it is to be of value to education. The present trio of books about school films gives point to the large-scale L.C.C. experiment of taking some 13,000 children regularly to special programmes in normal cinemas over a short period of time. These books deal with the same subject, are of the same size and scope, sell at the same price and come to the same conclusions. One wonders why the authors could not have got together in some way to produce a more presentable integration of their ideas on their subject, and thereby carry greater weight. For each has original thoughts on his material.

The first book is a symposium from a number of educationists, the editor of *Sight and Sound*, and Mary Field, and covers the ground of making, using, and following-up classroom films of various kinds, including a section on technical data of projectors and their operation, and lists of library films available. The second is by a schoolmaster who makes good documentary films for himself and for his students ; John Grierson contributes his recommendation in a Foreword. The author is concerned with the organisation of the curriculum, and groups series of beautiful stills from well-known documentaries to illustrate types of appeal. The third book has the more practical side in view and reviews the present sources and types of film available. All the authors conclude, after noting the results of many experiments with classroom film teaching, that

(*Continued at the foot of the opposite page*)

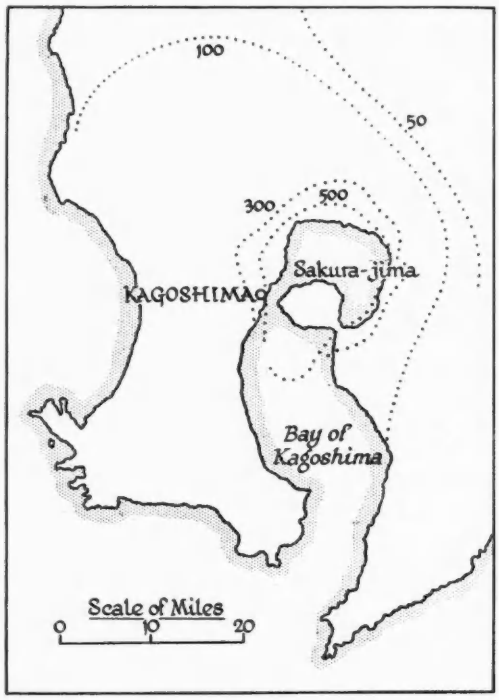
**The Film in the School.* Edited by J. A. LAUWERYS. (Christophers. 3s. 6d.)
*The Cinema in School.* By W. H. GEORGE, B.Sc. (Pitman. 3s. 6d.)
*The Cinema in Education.* By D. CHARLES OTTLEY. (Routledge. 3s. 6d.)

# Post-Eruptive Movements of the Earth's Crust.

**By Charles Davison, Sc.D., F.G.S.**

*The study of volcanoes and their effects is a vital matter to Japan; even after the first violence of the eruptions has subsided, the earth's crust may take years to settle, and Dr. Davison here records some interesting observations that have been made over a considerable period.*

FROM the south coast of Kyushu, the most southerly of the main islands of Japan, the Bay of Kagoshima runs northwards for more than 40 miles. Near the north end of the bay rises the volcano of Sakura-jima, that, before the eruption of 1914, was an island six miles long from east to west and five miles wide, and separated from the mainland by channels of 77 and 45 fathoms in greatest depth. The first eruption, preceded as usual by many slight earthquakes, occurred at 10 a.m. on January 12th. It was followed by many others, but, after 24 hours, these were greatly reduced in violence, though not, perhaps, in frequency. In less than a fortnight the eruptions on the west side of the island were practically at an end. Those on the east side, lasted a longer time, and even as late as in the following August there were occasional strong outbursts. Lava issued from seven craters on the west side, and from eight on the east side, of the mountain. The lava streams on the west side had a total area of about 3¼ square miles and a volume of about .08 of a cubic mile. Those on the east side coalesced and formed one stream, six square miles in area and .29 of a cubic mile in volume. It completely blocked up the channel on the east side, thereby converting Sakura-jima into a peninsula. The total volume of ashes was estimated at .15 of a cubic mile, so that the total volume of solid material ejected was slightly over half a cubic mile.




*Depression of the earth's crust around Sakura-jima.*

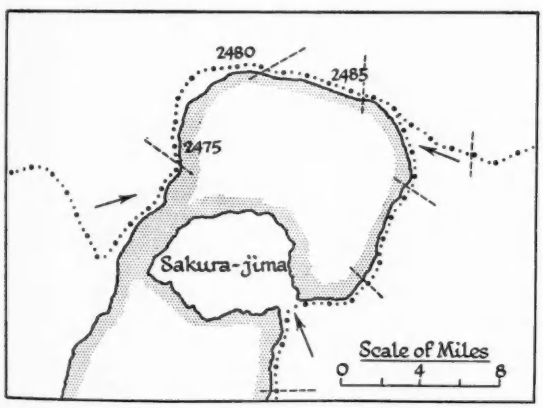
From December, 1891, to January, 1895, a series of levels had been carried out by the Land Survey Department of the Imperial Army. This was repeated in 1914 soon after the eruption and again in February, 1915. The late Professor Omori, who studied the eruption in all its different aspects, has drawn a map of the district (reproduced herewith), on which are shown three curves of depression: 100, 300, and 500 millimetres, or 3.9, 11.8, and 19.7 inches. The last two curves surround the northern end of Kagoshima Bay, and their centres lie a short distance north of the volcano, a point that Omori regarded as that of greatest depression of the crust. He estimated the volume of depressed crust within the 300 mm. curve as one-fifth of a cubic mile, and of that between this curve and the 100 mm. curve as one-eighth of a cubic mile, the sum of the two amounts being, however, much less than the total volume of lava and ashes ejected.

A few years ago, Professor C. Tsuboi examined more closely the changes that occurred during the two intervals between the same series of levellings. The levelling route round the head of the bay is indicated by the dotted line in the second map, the black spots along the line denoting bench-marks. The curves in the upper diagram represent the changes of level in the two intervals, the continuous line those during the first interval (1895-1914), and the broken line those during the second (1914-1915). The scale used for the later interval is shown on the side of the diagram. For the earlier interval, the same scale represents changes ten times as great, or 50 and 100 cm. In the second interval, the depression of the bench-mark 2474, was 894 mm. or 35 inches. It is clear from this diagram that the two

graphs, though representing depressions of very different magnitude, are similar in form. Both consist of segments of straight lines, the most remarkable feature of which is that their corresponding ends lie on the same abscissæ. Professor Tsuboi concludes that these abscissæ indicate the boundaries of a series of crust-blocks, portions of which are represented by the broken lines in the map below.

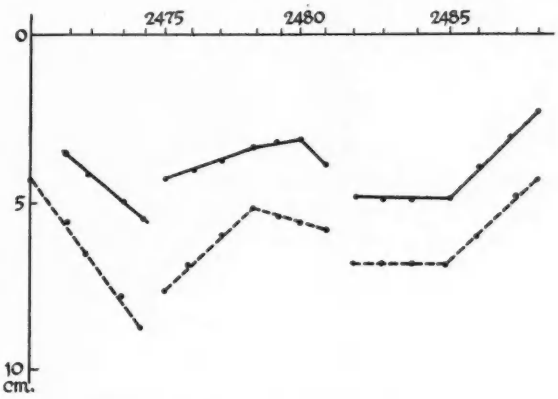
Round the head of Kagoshima Bay, Professor Tsuboi thus defines the existence of six crust-blocks, the width of each of which is about six miles. It will be noticed that, in three of these blocks, the levelling route is either forked or bends at a high angle. These blocks lie to the west, the north-east, and the south-east of the volcano. From the two inclined lines of levels in each, Professor Tsuboi calculated the amount by which each block was tilted and also the direction of tilting. These were 12 seconds towards N.58° E. for the block to the west, 9 seconds towards N.73° W. for that to the north-east, and 10 seconds towards N.31° W. for that to the south-east. The three arrows in the second map represent these directions, and it will be seen that they converge towards a point a short distance north of the volcano.

In 1919, and again in 1932, a fresh series of levellings



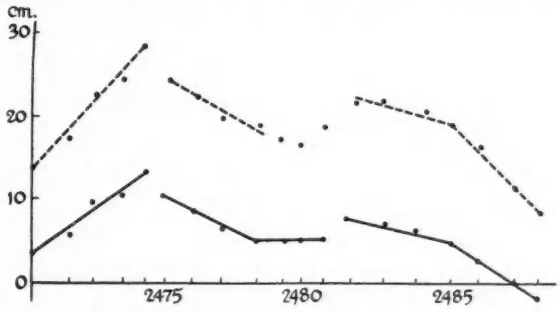

*Movements of crust-blocks around Sakura-jima*

was carried out by the Land Survey Department along the same route. They have been studied by Professor N. Miyabe. The graphs in the lower figure represent the changes that have taken place during the intervals 1915-1919 and 1919-1932, the continuous line those during the earlier interval and the broken line those during the later. It will be seen that the two graphs are similar in form, that they consist as before of segments of straight lines, the ends of which lie on the same abscissæ as those for the two early intervals. These breaks confirm Professor Tsuboi's inferences as to the existence




*Changes of level between* 1895 *and* 1915.

and boundaries of the crust-blocks. Instead, however, of the subsidence recorded above, the bench-mark 2474 was elevated by 132 mm. (5¼ inches) between 1915 and 1919, and by 282 mm. (11 inches) between 1919 and 1932, the recovery being thus at a somewhat slower rate during the later interval. The tilting of the blocks




*Changes of level between* 1915 *and* 1932.

was continued, that of the block to the west of the volcano in the same direction as at first, while those of the blocks to the north-east and south-east was reversed.

REFERENCES.

[1] F. OMORI. *The Sakura-jima Eruptions and Earthquakes.* Part IV. Imp. Earthq. Inv. Com. Bull., Vol. 8, 1920, pp. 323-351.

[2] A. IMAMURA. *Topographical Changes accompanying Earthquakes or Volcanic Eruptions.* Imp. Earthq. Inv. Com. Publ., No. 25, 1930, pp. 131-139.

[3] C. TSUBOI. *Block Movements as revealed by means of Precise Levellings in some Earthquake Districts of Japan.* Earthq. Res. Inst. Bull., Vol. 7, 1929, pp. 106-110.

[4] N. MIYABE. *Deformation of the Earth's Crust in the Neighbourhood of Sakurazima.* Earthq. Res. Inst. Bull., Vol. 12, 1934, pp. 471-481.

## National Trust News

THIS month the National Trust is able to announce three new acquisitions of land, one of which was a bequest from a well-known friend of the Trust and comprises 1,200 acres in North Wales. The other two are comparatively small areas.

The Welsh property is the Dolmelynllyn Estate which was left to the Trust by the late Mr. Campbell Blair. The Estate lies alongside the road from Dolgelley northwards to Festiniog, and the views looking down into and across the valley of the river Eden from the road in the neighbourhood of the Tyn-y-Groes Hotel are of very great beauty.

Dovedale is once more in the news with the gift from the Pilgrim Trust of important areas on both banks of the Dove. The Bostern Estate of 415 acres has been acquired from Lord Daresbury, and of this about 165 acres of the Derbyshire slopes of Dovedale will become the property of the Trust. The estate is in the heart of Dovedale and includes Bayley Hill and Bostern Nab—both over 1,000 feet—with views extending to Kinder Scout, Axe Edge Moors, and Chelmorton Low to the north and the hills of Staffordshire and south Derbyshire to the south. The other area lies on the Staffordshire bank farther north and comprises the Alstonefield Glebe land of 70 acres with a long frontage to the Dove.

### The Yorkshire Coast

The third property is noteworthy in that it is the first piece of the Yorkshire coast to come into the possession of the Trust, Miss L. T. Rowland having presented seven acres of cliff land at Saltwick, a mile and a half south east-of Whitby. The property includes about a quarter of a mile of the actual cliff and a small flat space at the bottom of it. The most remarkable feature, however, is a low rocky nab jutting out into the sea. This is of a striking colour as the rock is very dark except where in former times it has been turned dull red by burning, for alum. The bay is a popular objective for people who walk out from Whitby and can only be approached, except for those who go by sea, by climbing the 199 steps to the church and abbey and then continuing by footpath.

As well as these three gifts of land another important addition has been made to the Trust properties by the handing over by Lord Hesketh of Rufford Old Hall. Rufford is about twelve miles from Preston on the Liverpool Road and about six miles from Ormskirk. The Old Hall has not been used as a residence in recent years, and it will now be opened to the public as a place of considerable historic and architectural interest.

The National Trust has naturally taken very great interest in the negotiations which have been going on recently about afforestation in the Lake District. Probably few problems have aroused more discussion in the columns of the daily Press and there was a debate in the House of Lords before Easter. The whole question is one of considerable complexity as the Forestry Commission have been charged by the Government to carry out a policy of afforestation at the lowest possible cost and, if practicable, in districts which are near the special areas, in order to relieve unemployment. The greater part of the Lake District comes within fifteen miles of the special area in West Cumberland where the mining towns of Workington and Whitehaven have been hard hit.

### Lake District Afforestation

The Forestry Commissioners have planned forests in Ennerdale, Eskdale, and Dunnerdale and the Ennerdale forest is already partly established. The Eskdale and Dunnerdale scheme has aroused the greatest opposition from lovers of the Lake District who feel that the peculiar wild beauty of the innermost fells will be destroyed by the introduction of large acreages of larch and spruce planted in small rows on the hillsides. There has also been some anxiety about access to the mountains, which hitherto has been practically unrestricted, and about the future of the Herdwick sheep-farming industry which is the mainstay of the Lake District farmers.

The National Trust itself owns a number of properties which might be considered suitable for afforestation but they were, of course, acquired for preservation in their natural state, and, generally speaking, the Trust does not do any planting except where existing woodlands have had to be felled and it was desirable to replace them.

The Trust is not directly interested in the afforestation of the Lake District apart from its own lands there, which total about 12,000 acres, but it is always concerned about the preservation of the landscape in a part of the country which is so noted for its unspoilt beauty. The Executive Committee, therefore, decided to support the Council for the Preservation of Rural England who appointed members to serve on a joint committee to discuss this and other problems with the Forestry Commission. This joint committee originally hoped that the Forestry Commission might be persuaded to refrain entirely from planting in Eskdale and Dunnerdale, but this proved to be impossible as the Commission's operations had already gone too far, but it is expected that an agreement will be reached very shortly under which no planting will be done in the central area within about six miles radius of Esk Hause, and efforts will be made to find suitable planting areas on the outskirts of the district.

# Photo-Electric Exposure Meters.

By G. B. Harrison, F.R.P.S.

*Any photographer will admit his indebtedness to the photographic exposure-meter. Here it is claimed, and the claim justified, that the modern photo-electric type of meter makes a real advance in accuracy of measurement. The discussion of various types of meter and of various methods of use is of the highest interest.*

In the photographic process from the taking of the original scene to the production of the final print, the only operation that cannot be standardised is the exposure given in the camera, and any error made in this exposure cannot be remedied during subsequent operations as can such errors as too much or too little development. The estimation of the exposure is rendered difficult owing to the number of factors on which it depends. Intensity of light falling on the subject, type of subject, and speed of the plate or film, to mention the most important. It is not surprising, therefore, that a great deal of attention has been paid to the production of exposure meters, and has resulted in a number of different types which may be briefly divided into four classes. (1) The actinometers, depending on the time of darkening of a piece of print-out paper; (2) the visual meters depending in principle on the reduction in intensity of light reflected on to the meter from the subject, necessary to render a given number in the meter just visible; (3) the photometer types, balancing the light received from the subject against a light source contained in the meter; and (4) the photo-electric meters.

## Early Difficulties.

The photo-electric cell has proved itself so satisfactory for measuring and detecting light intensities that it might be wondered why it was not adapted for photographic purposes some time ago. The reason is that it would have been necessary to use a thermionic valve to amplify the photo-electric current given by the cell which, with its attendant batteries, would make the instrument both bulky and costly, and though it might be of value in the studio it would hardly be satisfactory for outdoor work where portability is of prime importance. With progress in the manufacture of photo-electric cells it became possible to do without the amplifier, but still a battery was required, which, though of low voltage, had to be provided with means for maintaining the actual voltage across the cell constant in spite of battery voltage fluctuations.

It was not until the appearance of a new type of light-sensitive cell, known as the rectifier or semi-conducting cell, that photo-electric exposure meters became popular. This type of cell in its original form consisted of a copper plate, having formed on one side a layer of cuprous oxide, on top of which was sputtered a very thin conducting layer of gold or other metal, thin enough to be transparent to light. Contact was made to the gold layer and to the copper plate, and on exposure to light a current flowed through a meter from the copper to the gold *without the use of a battery*. It was soon found that sensitivity could be greatly increased by using substances other than copper and cuprous oxide and this led to the development of the modern semi-conducting cell which, with a surface area of about two square inches, will yield a current of five to ten milliampères in sunlight.

## Advantages of the Rectifier Cell.

The great advantage of this type of light-sensitive cell over previous cells from the point of view of the photographer will be immediately obvious; it requires no battery to obtain the photo-current, the current requires no valve amplification, and sufficient current is generated under all normal conditions of daylight and all reasonable intensities of artificial light to operate a robust form of current-measuring instrument. It should be mentioned also that the cells used in photographic meters are sensitive to the whole visible spectrum, and have a maximum sensitivity in the yellow region.

## Alternative Types of Meter.

Let us now consider and compare the means available of estimating photographic exposures. The actinometers measure the relative intensity of the light at the position of the photographer, and, owing to the nature of the print-out paper available, the blue, violet, and ultra-violet light only is taken into account. This latter point was an advantage in the days of blue-sensitive materials when actinometers were first put forward, but has lost this advantage now green-sensitive and red-sensitive materials are so universally employed. The measurement of light intensity falling on the photographer does not necessarily represent the light intensity falling on the subject, and in some instances it may not be possible for the photographer to reach the

subject to take the reading. The visual extinction meters were an attempt to overcome the latter difficulty in that they operate by means of the light reflected from the subject, but since they depend on the estimation of a number or figure which is just visible or just not visible, it will be readily imagined that different observers will obtain different results. Even the results of the same observer will be variable owing to the varying sensitivity of his eye according to whether he is himself situated in a bright or dull light. In order to overcome this difficulty it has been recommended to place the meters to the eye and wait 20 or 30 seconds before making the observation, in order to allow the eye to recover from a bright light, but this is only a partial remedy.

The third type of meter, the photometer, has the advantage of the extinction meter in operating by means of light reflected from the subject and overcomes the disadvantages of the variable eye sensitivity by employing a standard light source for comparison, but here is introduced a new disadvantage, that a battery must be used to excite the comparison light source and means must be provided for ensuring that the battery delivers a constant current to the lamp.

Coming to the photo-electric exposure meter, we see that if the cell is directed towards the subject to be photographed with, for example, a lens to limit the light received to the boundary of the picture we shall be taking an average light intensity value of the subject. The eye is not required to make any judgment, so we have overcome the disadvantage of the extinction type of meter, and no battery or means of standardisation is necessary as in the photometer type of meter. It would appear, therefore, that all the difficulties have been overcome, but it would be a man easily pleased who said that the perfect exposure meter had arrived !

### The Ideal Method.

The exposure necessary under any given set of conditions depends on the actual photographic intensity of the light falling on the plate or film. This in its turn depends on the intensity of the light falling on the subject, the colour of the subject, and the aperture of the camera lens. If the range of intensities of the subject is equal to or smaller than the range of intensities that can be reproduced by the plate or film being used, the correct exposure will be given if the lowest intensity received from the subject (the deepest shadow) is sufficient to produce the minimum useful density on the plate after development. Theoretically, the obvious way to achieve this would be to explore the image in the camera with a light-sensitive cell and measure the intensity of light received from the deepest shadow in the subject ; this would then give a direct indication of the exposure, provided the meter was calibrated. It should also be stipulated that the photo-electric cell should have the same spectral sensitivity as the photographic emulsion used, so that the correct reading is obtained whatever the colour of the shadow portion of the subject.

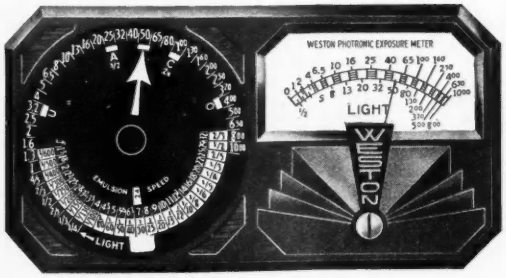
There are, unfortunately, several factors which make the above procedure difficult if not impossible at present. Firstly, it is very inconvenient to explore the image plane in a camera with a photo-cell, especially in the case of the roll film camera, and secondly, the rectifier type of cell, if reduced in area sufficiently to be able to receive light from a small and dark portion only of the subject image, would not be sufficiently sensitive to give an accurate reading on a portable current measuring instrument.

### Solving the Practical Difficulties.

In the practical use of photo-electric exposure meters two different compromises are made Either the whole of the light from the subject is received by the cell surface and an average intensity reading obtained, or the intensity of the deepest shadow of the subject may be measured by approaching the subject more closely and directing the meter towards the shadow portion. In both these methods the aperture of the camera lens is left out of consideration, but this is not a serious drawback since it will be accurately known and the necessary allowance can easily be made. The former method is the most popular owing to its simplicity, though it is theoretically the less accurate, as it will readily be seen that the exposure obtained will depend not only on the intensity of light received from the subject but on the relative quantities of light and shade in the subject. For example, in the case of a subject consisting of a full-length figure standing in front of a light wall the average light intensity received by the meter will be high because the light wall will supply perhaps 80 per cent. of the total light received, and, consequently, a short exposure will be indicated ; but if the light wall is replaced by a dark wall, the average intensity will be low and therefore yield a high exposure value, yet, obviously, unless the dark wall represents the deepest tone in the whole picture, exactly the same exposure should be given in both instances. It must, however, be pointed out in support of this method of estimating exposures that the range of tones reproducible by modern emulsions is greater than the range of tones existing in a normal subject and, therefore, several different exposures can in practice be given and all regarded as correct, since, by adjusting the printing exposure, identical prints can be obtained. It is this

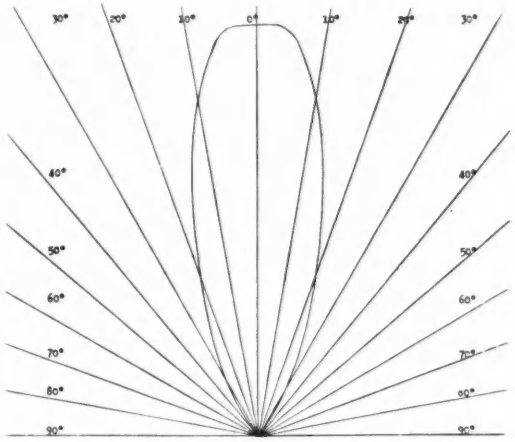
fact (known as the latitude of the emulsion) that makes this method of exposure calculation feasible. The second method is, strictly speaking, more certain and can be operated with a photo-electric meter by estimating the intensity of the deepest shadow in the subject by approaching it as near as possible with the meter, taking care that neither the meter nor the body reduces the intensity of the light falling on the part of the subject concerned. If the meter is then directed towards the shadow it will give a reading proportional to the intensity of light received by the plate from that part of the subject, allowance being made for the aperture of the lens. This can then be interpreted into the exposure necessary to produce the lowest useful density on development.

The photo-electric photographic exposure meters available are all essentially the same; they consist of a light-sensitive cell of the rectifier type directly coupled to a current-measuring instrument of the double-pivoted pointer type. Some contain a resistance that can be short-circuited by means of a push-button to obtain a double range of sensitivity, and others are operated by adjusting the pointer to a standard deflection by turning a calibrated variable resistance. Over the surface of the cell is some form of limiting device to limit the angle of "view," so to speak, of the cell; this may take the form of a lens, a honeycomb, or even lightly ground glass, and the actual angle of "view" varies considerably amongst the various meters as would be expected. A typical exposure meter and its polar curves are shown in the accompanying illustrations. In the polar curves the centre point of the base line is the position of the meter and the distance between this point and any point on the curve represents the




*A typical photo-electric exposure meter.*

relative sensitivity of the meter in the direction of the line joining the two points. It will be seen that the "angle of view" of the meter is small in this instance and lends itself to the measurement of small parts of the subject. Each meter bears a sliding scale device or a set of tables for making allowance for the speed of the emulsion being used and the aperture of the camera lens, so that no calculation is necessary; the reading of




*Polar curve of the Weston exposure meter.*

the meter is taken, and by a simple manipulation of the scales or reference to the table, the exposure is read off direct for the given emulsion and aperture used. In the case of cinematograph work where the exposure is set by the shutter, the correct aperture to use is read off in a similar manner.

As the modern photo-electric exposure meter has been claimed to be a great advance on previous meters, let us weigh it in the balance and see whether this claim is justified. However used, it gives a reading in less than half the time taken by any other meter, thanks to the rapidity with which the pointer sets itself compared with either timing the darkening of the actinometer paper or making a visual observation in the extinction or photometer type of meter. The photo-electric meter gives a more reliable reading than the extinction type; it gives a more representative reading of the *photographic* intensity of the light than the actinometer when ortho or panchromatic plates are used, since the sensitivity of the photo-cell extends over the whole visible spectrum. The only disadvantage that can be assigned to the photo-electric meter as it exists to-day is lack of sensitivity, and whilst it is amply sensitive for all reasonable conditions of daylight and any other reasonably bright light it is liable to fail or be uncertain in such subjects as dark interiors—of churches, for example.

In conclusion, it cannot be too strongly emphasised

that no exposure meter, not even the photo-electric, is infallible. Two methods of use have been outlined and, whichever is used, if the best exposure is always to be obtained, the photographer must fully understand the theory of exposure and the principles of operation of his meter. He must use this knowledge in conjunction with the reading obtained with the meter if he is to avoid the pitfalls that may occur from time to time under certain conditions of lighting, subject, etc. In fact, it can be truthfully said that just as any craftsman must fully understand his tools before he can produce first-class work, so the photographer must fully understand his camera, exposure meter, and materials before he can produce technically first-class photographs with confidence.

## Correspondence.

### BRITISH THUNDERSTORM SURVEY.

*To the Editor of* DISCOVERY.

SIR,—The annual census of thunderstorms in the British Islands is being continued during the present season. The help of your readers in the work of observation, particularly in rural districts and in thinly populated areas, will again be very warmly appreciated.

The main details required are the place, date and time of the occurrence, in any part of the British Isles, of thunder, lightning or hail, with the direction in which the lightning is seen, especially at night. Details and reports of damage by lightning are also specially desired.

Any note, however short, for any day is valuable and no special apparatus is needed for making observations. Post-cards for records are supplied, and a station number will be allotted to specified places of observation.

I shall be glad if new observers, willing to co-operate in the survey, will kindly write to me for fuller particulars.

Yours faithfully,

S. MORRIS BOWER.

Thunderstorm Census Organisation,
Huddersfield.

### THE WANDERING OF THE CONTINENTS.

*To the Editor of* DISCOVERY.

SIR,—The late Dr. Alfred Wegener, the German geophysicist, advanced his theory of Continental Drift as a reasonable hypothesis; geologists cannot be said, on the whole, to treat it very seriously. The article, *The Wandering of the Continents*, in the March number of DISCOVERY, considers it proved and definitely accepted in its fullest implication.

Is it really so certain that Cape San Roque at one time occupied the place of the delta of the Niger? If the two coast lines have now warped a little—and why should one be tied down by the fact that the edge of the continental shelf marks the coastline?—we can still let them contribute to "verifying the fact that the continents actually move, either apart, or toward one another." It sounds abstruse, but "thus the puzzling problem of persistent and similar orders and species of invertebrates on either side of the Atlantic has been cleared up."

The fossil, *Glossopteris flora*, so different from the contemporary European flora, which is found in Africa and South America, also in India and Australia, is not mentioned; however, "we can only correlate the observed data by assuming that the earth's upper surface 'floats.'" Most geologists assume a former land-bridge, and they point to the fact that this same fossil flora has been found in northern Russia and in Siberia. The trouble is that these northern countries are so far away from where the theory can allow them to be if they want to keep the fossils. For the theory, as here advocated, postulates the tendency of continents to rotate latitudinally, thus setting up meridianally directed forces which lead to a westward continental drift. Surely that is clear. It must be the observed facts that are at fault. If the "south-polar-directed apices of the great land masses" ever were in contact with Antarctica, which is still at the south Pole, they have moved meridianally.

It is only fair to admit that some parts of the article may be misinterpreted, for it is not always easy to disentangle the intended meaning from the words and construction used. One statement is quite clear: the British Isles once were, or now are, part of the North American continent. They are, as plain as plain can be, part of the Eurasian shelf. Something has gone wrong. Also about "big mountain chains, which . . . find their continuation, as the Pyrenees do, in North America." It may be as well not to let the Asturias know that they have drifted across the Atlantic.

If we assume that the various parts of the earth's *crust* (not of the world's "outer mantle" which is the atmosphere) *have* drifted, and that at one time there was an Africa-South-America continent, we are at liberty to join it to a united Antarctica, Australia, and East Indies. San Roque we again place in the Gulf of Guinea, for an easy point of reference. There is an immediate dilemma. The two South-Atlantic coastlines "as we know them" are, for our purpose, fanciful. The reason is that, change in sea-level apart, the edge of the continental shelf is the edge of the continent, and here the two edges do not fit in. But suppose it can be done. The South Sandwich Islands then come to be somewhere north of Enderby Land, and Cape Horn is about half way between Cape Agulhas and the point referred to as "Bellingshausen, February, 1820." If South America *drifted* into its present position, its southern apex and lightest part drifted farther than its very much greater land mass. And, as the apex swung round, Antarctica must have got a violent jolt. Then there is the relatively shallow sea, or high shelf-level, from Iceland to the latitude of the Falkland Islands, all the way fairly equidistant from the two continents, while deeper parts, some very deep, are scattered irregularly nearer the one or the other continent.

These are awkward facts, but a mere detail when we try to fill the expanse of the Indian Ocean by adding Australia, Polynesia, Melanesia, and the East Indies to its own sparse islands. When we have got them spread out as prodigally as we can we shall still be some twenty-five million square miles of land in arrear. Of course, if they *had* drifted west (as they ought to have done) instead of towards the east, — — ?

None of these remarks intend to endorse or to contradict Wegener's theory, or Joly's. For there is not now, nor is there ever likely to be, fitting evidence for or against the unimportant magnitude of the subject. Contrasted with the area of the earth's crust, let alone its mass, our knowledge of a few points of its

bulk is miserably small and incomplete. As for Continental Drift, we have not one clear proof of it.

The Editor's prefatory note says: "... has studied the question from the point of view of the mining engineer." Studied? It may be so; but the question? No. Where clear explanation of origin and implication, of arguments for and against could be given, there is lame discourse and vague assertion. And, of all things, from the mining engineer's point of view! What mining? A colliery manager's, a placer miner's? And what standing and experience as an engineer? A lad newly articled to a firm doing routine surveying? An astute manager of some famous plant, in the administration of which efficient mining is no more than an incident? A versatile consulting engineer with a lifetime of varied experience, who gives his employer a lucid account of an examination of a mine or a prospect and shows, step by step, how he arrives at his conclusions? Is the scientific spirit, without which the mining engineer's work would be mockery, to be put on a level with a tyro's rambling rhapsody about some conjecture?

Yours faithfully,
C. J. WILSON.

San Francisco, Calif.

*To the Editor of* DISCOVERY.

Sir,—I send herewith my reply to Mr. Wilson's epistle. His initial arguments are well-known ones, and it is unfortunate that he should regard my remarks as *proof* of Wegener's hypothesis; I was merely supporting the hypothesis from the mining engineer's point of view. His attack appears to be based on the meaning of certain common words and his interpretation of them. Indeed, he appears to be searching for faults and such prospectors seldom go unrewarded. For instance, when a mining man speaks of the outer mantle of the earth he means what he says: *viz.*, the outer crust of rocks and not the atmosphere, as suggested; for otherwise the stratosphere could be raked in; and in this way the puerile quibble continues. But to give him his due he lacks not dogma, for does he not say that such and such "is as plain as can be"? Well, surely, while the things I write may not be plain to him, it is highly probable the converse may be true. Following this, this person who doesn't know me or my work, descends to the tactics of the slum by abusing me personally as a mining man. Now, sir, I have been engaged in all phases of mining for over 35 years, having been right through the mill. I am not one of these mining "experts" who go from the elementary or preparatory school to the secondary or public school, and from there to the University, to come out with a degree in Mining without ever seeing the inside of a mine. I did over ten years of actual mining in peace before entering the University, and in the war my mining work was a man's job. Moreover, I have travelled every mining field of any account in Europe, and many in the U.S.S.R., and for years have had charge of mining education, with 4,000 students weekly in the very heart of England. If Mr. Wilson knows anything of mining lore he will know that I have researched and translated and written for over 20 years. While he is taking a tilt at myself and geophysical knowledge he will, if he is a fair sportsman, admit that I am one of the pioneers of that subject among British mining men.

Yours faithfully,
M. H. HADDOCK.

Coalville, Leics.

## THE FUTURE OF BRITISH INSECTS.

*To the Editor of* DISCOVERY.

Sir,—I must thank the correspondents in the last issue for their criticism of my insect article, and appreciate their recognition of the difficulties of condensing into one article such a big subject as the future of insect life. They ought to realise, though, that I quoted the cherry fruit fly merely as one example out of very many, and, regarding crediting the Ministry of Agriculture with derris-wash advice against warble-fly attacks on cattle, they seem to ignore the experiments of Bangor University as far back as 1930, which gave the first scientific experimental proof of the value of derris treatment for warble-infected cattle.

I entirely disagree with the statement that most "plagues" of house-crickets occur in the south. The correspondents admit frequently their ignorance of northern conditions: at an inquest, before Mr. J. A. Ferns, East Cheshire Coroner, at Alderley Edge, on January 12th, 1934, it was officially stated the deceased, sanitary inspector to Hale U.D.C., had committed suicide because he found the plague of crickets in his district unbearable. I have failed to find a record of southern plagues so numerous as actually to result in suicides.

In *Country-Side* (Spring, 1930, p. 427) observations by reliable entomologists on the decrease of field and house-crickets in the South were given. I have experience of working-class homes in the North, Midlands and South, and have no desire to withdraw my statement that the house-cricket is more numerous in the North, even apart from the fact that there are more people and more houses in the North, simply because slums, and old-fashioned kitchens are far more numerous in the North.

My experience of uncontrolled camping increasing mosquitoes is in places where the authorities made inadequate provision for drainage or sanitation and where the sudden popularity of the place caused large-scale use. True, the examples are limited and local, but they have occurred.

While, of course, I am replying to my critics in good faith, I do think the suggestion that because they had not heard of a Liverpool Colorado Beetle record, it must be an error, is a dictatorial view; for by no means does every natural history record get down to London or appear in scientific journals. The Liverpool record concerned a ship that had landed a Texas cargo about 1880; the instance was preserved in local records and reported in the press.

I still feel that in a summarised discussion on the future of British insects, the increasing or decreasing effect of alien pests on goods and crops has far more importance for the future than a multitude of native species which may considerably outnumber the aliens specifically, but have very little effect on economic materials. Indeed, my article was criticised in a trade journal for treating the pest question far too lightly.

To practically all the business community storing goods at our ports, the sole interest in the future of British insects is whether pest damage will go on increasing or be controlled; such men have no time to waste on statistics and observations on native species which may be more numerous than the aliens but are without economic influence.

Still, I thank my critics and appreciate their views on the question.

Yours faithfully,
ERIC HARDY.

Liverpool.

# The Preservation of Records.

By Julius Grant, Ph.D., M.Sc., F.I.C.

*The rapid advance, in the last fifty years or so, in the methods of paper-manufacture has not always been conducive to the production of high-quality material; with the result that many documents under fifty years old are in greater danger of loss than others centuries their senior. The question of their preservation is one of immediate importance; the best method to apply still remains to be determined.*

It is almost superfluous to emphasise the importance of a study of the permanence and preservation of records. In the first place, many callings, such as that of the scientist, cannot be followed successfully without records of past work, and although cynics sometimes argue that little of this is worth considering where the question of permanent value is concerned, there is always wheat among the chaff, and one person's chaff may be another person's wheat. It can, however, be a really serious problem in the case of valuable documentary matter, past, present and future, and particularly of documents of State, archives, records, rare editions of books and special publications of all kinds.

The remarkable state of preservation of many ancient documents is always a source of comment to the museum visitor, and it is controlled by a number of factors. The principal of these, in order of importance, are the composition of the paper or other material and the nature of the processing this material has undergone; the conditions under which it has been exposed; the type of ink used; and the degree of handling to which the document has been subjected.

### The Advent of Wood-Pulp.

It must be realised that until the sixties of the last century rags were the only paper-making material of any importance. Paper was made from them by hand, the paper-maker's craft, like many others, being usually exercised with every care and attention. Even to-day we must admit that a well-prepared rag paper stands pre-eminent for permanence. In addition it must be remembered that since only the fittest survive, most of the specimens we see now represent the best of their kind originally, and they have probably been stored under the most favourable conditions. On the other hand, the question of permanence received little attention during the rapid initial development of the mass-production of paper from wood-pulp by machine. There was no past experience to demonstrate the superiority of rags over wood in resisting the ravages of time, and the investigations of the chemist had not yet demonstrated the importance of care at certain stages in the processing of the material. This lack of knowledge is now being brought home very forcibly by the parlous state of many cheaper papers 40 to 50 years old, and as many of these are of permanent value, the problem of their preservation is a serious one.

A report of the International Institute of Intellectual Co-operation of the League of Nations issued in 1932 shows that this danger is world-wide. According to the Public Record Office, 1890 to 1900 is the worst period, but records of the war-period belonging to a number of the small nations are in an equally bad condition.

### New Methods of Testing.

Responsible bodies in different countries are, however, now alive to the situation, and they have therefore drawn up specifications for durable papers. Those suggested by the Library Association, for example, provide for two types of paper according to the degree of permanence desired. Papers in the higher grade are made from new rags, and they should contain a minimum of acidity, iron, loading, and sizing. The cheaper quality contains well-washed chemical wood fibres, and has an ash-content not exceeding 5 per cent., a rosin content of $1\frac{1}{2}$ to 2 per cent., and minimum quantities of alum and iron. Subsequent specifications by official bodies have followed similar lines, although as the chemical knowledge of paper has advanced additional requirements have been introduced. The "alpha cellulose" content, for example (which is the amount of "true" cellulose), is held in some quarters to be of importance, although the analyses of a number of papers dating from the 11th century suggest that the most permanent of these did not necessarily have a high initial alpha-cellulose value. In another very useful test, proposed by the Bureau of Standards, Washington, the percentage decrease in the folding-strength of a paper after it has been heated for 72 hours at 105°C. is taken as a measure of its permanence on ageing. The validity of this method is still under discussion, but the general opinion based on short-period tests is, that in conjunction with the other criteria mentioned above, it provides a useful indication of stability. The long-period tests will, however, finally decide the true value of the method, and although such experiments have been started it must be left to future generations to complete them.

Nevertheless, it is not difficult on the whole to draw up a specification for a paper ensuring the maximum

degree of permanence, so long as the paper can be made regardless of trouble and expense. Such papers, however, do not always give the best printing effects, because most of the world's printing paper is composed of wood cellulose, and the inclusion of esparto grass is desirable, particularly where high class illustrations are involved. The problem therefore is still a real one where cheaper grades of production are concerned. One thing is certain, and that is that a well-prepared wood or esparto paper can be more permanent than a carelessly processed rag paper, and this important statement really sums up the contribution of modern research to this branch of the subject.

### Atmospheric Pollution.

As already mentioned, the conditions of storage also determine the degree of permanence of a paper. Exposure to light, heat, and atmospheric pollution all hasten the decomposition of cellulose, and as might be expected from purely chemical considerations, this is stimulated when the acidity of the paper or the humidity or temperature of the air is high; the problem is therefore particularly acute in tropical countries. Conditioned air for libraries and exclusion of light and heat are the obvious solutions, and this plan has been adopted in several American institutions. The most potent form of atmospheric pollution is sulphur dioxide, which forms sulphuric acid in the paper and accelerates degradation considerably. The passing of gas for the illumination of libraries has done much to eliminate this, but in congested urban districts it is advisable to wash the air in a dilute alkaline solution. Similar considerations apply, of course, to bookbinding leathers.

The ink is the final factor of importance in determining permanence and this applies particularly to writing inks. Here again absence of acidity is vital, and the writer has handled old documents in which the written portion has dropped out, leaving the outlines of the writing as holes in an otherwise fairly stable paper. According to the League of Nations Committee (*loc. cit.*) carbon black is the best ingredient for printing inks, and blue and violet typewriter ribbons are undesirable. For writing purposes most iron and tannin inks are satisfactory (so long as the acidity is a minimum), although a number of so-called permanent inks of doubtful efficiency have been suggested.

In conclusion it is desirable to consider what steps should be taken to deal with records that have already started to decompose, or with new documents of special value. There are two alternatives: special treatment of existing documents; and the use in the future of a material more permanent than paper.

The simplest expedient in the first category is to "paint" the document with good quality gelatine. The disadvantages of this method are that it is necessary to renew the coating every 50 years or so; the colour of the paper becomes poorer; and it is not always considered desirable to tamper with a valuable document in this way. Moreover, if the gelatine is used too hot, the ultimate rate of deterioration of the paper may be accelerated. Numerous other forms of protective coating have been suggested (e.g., lacquers, varnishes, cellulose or its compounds, etc.), but they are all open to some objection; they often involve the use of an inflammable solvent, and they may peel, crack, and in some cases deteriorate in colour and strength more rapidly than the paper itself. One of the best methods is to paste a good quality Japanese tissue on to both sides of the document, using a pure rice-and tapioca-dextrin paste. The composite is dried slowly and pressed, and the resulting sheets are 3 to 4 times stronger and may conveniently be bound.

Such documents are, of course, increased in bulk and weight, and the written matter is somewhat obscured. Sheets of transparent cellulose, 0.001 inch thick, have been used to overcome these objections, the acetate cellulose being preferable to viscose, as it is usually less permeable to water, less brittle, and more permanent. The document is sandwiched between two such sheets for three minutes at 265°F. under a pressure of 750 lbs. The edges are sealed with cellulose sheeting, and the composite sheet is then quite impervious to air.

These methods are to be recommended in cases where the documents are to be handled frequently (e.g. old newspapers, records, etc.), but it is perhaps preferable in such cases to make photographic or photostatic reproductions on a high-class durable paper. Incidental to this is the recent decision of the California University Press to print a special edition of 25 copies of scientific works on a "permanent" all-rag paper, and to distribute them among a selected list of depositories throughout the world. The extra cost is very small, and the scheme is highly commendable and is worthy of the attention of public-spirited publishers elsewhere.

### Substitutes for Paper.

Another proposal, also originating in America and intended principally for newspapers, is to reproduce each page on a photographic film 1 × 1¼ inches in area. The wording could then be projected on a screen as required and the film renewed or duplicated, if necessary, from a photograph on a glass plate which could be filed in a safe place to avoid breakage. Such photographic records should have a high degree of permanence, and investigations on this point are in progress. If a

process of this nature matures it may well revolutionise library methods and solve the eternal question of storage-space.

In conclusion a word must be devoted to materials other than paper, and it must be admitted that no really satisfactory substitute is yet forthcoming. In the Digby process (*The Times*, Oct. 9th, 1933) records are reproduced photographically in platinum script on a sheet of 14 to 18 carat gold, 0.004 inch thick. This method doubtless would produce a "document" immune to natural deterioration or injury by burial, water, or the ravages of insects, although protection against fire is far less certain. The cost would probably limit the use of such a "noble" metal to a small and select aristocracy of documents, and these would provide a tempting bait to thieves. They would certainly be much more easy to dispose of than valuable paper documents, for gold becomes merely so much metal once it has reached the melting crucible, and in times like the present to be "worth its weight in gold" is something more than a saying.

## The March of Knowledge.

**Testing Road Surfaces.**

A road-testing machine, stated to be the largest of its kind in the world, has just been completed at the Road Research Laboratory of the Department of Scientific and Industrial Research, Harmondsworth, Middlesex. It consists of a 12-ton lorry, tethered to a central post by a 5-ton structural arm, driven by a 180-horse power electric motor. It travels round a track 110 ft. in diameter and 10 ft. in width, and it has a maximum speed of 40 miles an hour. There is a traversing arrangement to give uniform wear, and water sprinklers are used to imitate rainy conditions. It is significant that in most cases the road wears out before the tyres. Needless to say, special safety devices have been installed to prevent the lorry breaking away and thus releasing a colossal centrifugal force.

**Ectogenetic Rabbits.**

Dr. Gregory Pincus, of the Harvard Biological Institute, reported at the recent annual assembly of the Federation of American Societies for Experimental Biology, that he had succeeded in transplanting an embryo, produced by artificial fertilisation of a rabbit ovum, into a female rabbit, which in due course gave birth to a normal litter. He was, moreover, able to fertilise an ovum in a test-tube by merely exposing it for a few minutes to a temperature of 113° Fahr., an advance on his previous method of using a strong salt solution for fertilisation. He pointed out that all such ova, fertilised without the male element, must necessarily produce female rabbits, as they would be lacking the sex-determining chromosome which can only be provided by the male element.

**Excavations in Malta.**

The Maltese Government has acquired the site of the so-called "Giants' Tower," in the sister island of Gozo. Though this was the first known prehistoric temple of the archipelago, it has hitherto been impossible to explore owing to its being private property. The excavations will start next summer, according to the Valletta correspondent of *Great Britain and the East*, and it is confidently hoped that much light will be thrown on the Stone Age civilisation which, for reasons hitherto undiscovered, found its crowning point in Malta. Archaeologists are watching the course of the excavations with great interest, since the numerous monuments of the Stone Age in Malta—the work of clever builders and artists with a first-rate knowledge of architecture—are one of the wonders of the remote past.

**Palestine Survey.**

The same journal records that the Palestine Exploration Fund and the British School of Archaeology are undertaking an archaeological survey in Palestine similar to that made 65 years ago by Lieut. H. H. (later Earl) Kitchener, who, with Captain C. R. Conder, completed a remarkable topographical task in surveying the whole of Palestine. Those who served on the Palestine Expeditionary Force remember with gratitude the mapping work undertaken by the two officers named above.

**Roman Village Site.**

The burrowing of a rabbit at Diss, Norfolk, according to a report in *The Times*, has led to the discovery of the site of a Roman village on the outskirts of the town. A dark substance scraped up by the rabbit proved to be Roman pottery, and when the site was explored recently, bronze coins of the 1st-3rd centuries, and pottery dated A.D. 200 were found. The foundation of a Roman building, 12 ft. square, a flint hearth, and a causeway several feet wide leading down to the River Waveney were also discovered.

**Filming the Lapps.**

Plans have been completed, the *Manchester Guardian* reports, for the taking of a film depicting the Laplanders and their lives in the Arctic wilderness in which they roam and pitch their tents. A party of forty men will be engaged in the expedition, and scenes will be taken

from Swedish Lapland to the White Sea, following the Lapps in their wanderings with their herds farther and farther north as summer advances. The film will be played in Swedish, Finnish, and Norwegian. Its actual production will take about a year.

**Freezing of Niagara Falls.**

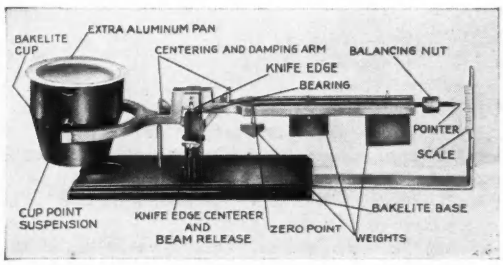
Dealing with the freezing of the American Falls on the Niagara River earlier this year, the High Commissioner for Canada in London publishes a report, from the Hydrometric Bureau in the Dominion, that, on January 25th, the American Falls became completely frozen over, and this condition had been maintained up to the date of the report (February 20th), with only minor streams of water on two or three days. The flow of water over Niagara Falls is usually not greatly lowered by ordinary winter weather and even extreme low temperatures affect it comparatively little, owing to the high velocity of the current and the large discharge of the river. There is no record of the much larger Horseshoe Falls ever having been completely frozen, and its occurrence is highly improbable. However, the channel leading to the American Falls, being shallow and carrying only about five per cent. of the flow over the cascades, at times becomes obstructed by ice and the American Falls may be completely dried up by frost. Freezing of the falls has occurred much more frequently since the diversion of water for power purposes, but the blockade this year was of record duration.

**British Castles.**

Reports have come to hand this month of some important discoveries in connection with British castles. The Office of Works have been excavating at Peveril's Castle, the romantic stronghold that dominates the Derbyshire village of Castleton. All that was hitherto visible was the small late-Norman keep, built by Henry II on the site of what was supposed to have been a refuge of William Peveril, natural son of the Conqueror. Now, however, traces of a much more extensive building have been revealed, with the foundations and bases of the walls of a great hall, containing fireplaces of two ages—one a primitive central hearth, the other a chimney-fireplace. Private enterprise, meanwhile, has been at work at Sherborne Castle. Here there are really two castles, the earlier an episcopal stronghold, which legend assigns to the Saxon bishops of Sherborne, and which dates at least to the beginning of the 12th century. The other castle was built by Sir Walter Raleigh in 1594, and one of the most interesting finds apparently indicates that Sir Walter tried to make the old castle habitable before deciding on the new one. The removal of trees has opened up fine prospects of the buildings.

**New Chemical Balance.**

There has always been a need for a low-priced chemical balance of great accuracy. It is claimed by the manufacturers, the Chemical Publishing Company of New York, that the Bennett Balance satisfies these conditions. It weighs up to 100 grams and has a sensitivity of 1/100th of a gram. It is less than a pound in weight, and about twelve inches long, and because of its small size and weight it can be carried in a pocket from place to place where ordinary balances would be too clumsy and heavy. It is made of black bakelite and light metal alloy, and its solid construction makes it available for hard usage. There are no loose weights to be lost. It has an alloy steel knife edge and a highly-polished agate bearing, which make for great sensitivity and durability. A special beam arrest prevents excessive wear of the knife edge and centres the latter automatically for each weighing.




*The Bennett Balance.*

**Improved Exposure Meter.**

The technical advantages of those photographic exposure meters which are actuated by the photo-electric cell are demonstrated in an article in this issue of DISCOVERY (p. 151). A further requirement, which is purely a practical matter, is that exposure meters should be small in size and handy to use. The latest model of the "Avo" exposure meter, illustrated herewith, goes far to satisfy this need. In size it is only 2½ in. by 2⅛ in. by 1 in., and it can be held and operated by one hand, without removal from its case. Technical requirements are met by an extensive scale of sensitivity; it gives readings for exposures from one minute down to 1/2000th second.

*The New Avo Exposure Meter.*

# Book Reviews.

*Old and New: Thoughts on the Modern Study of History.* By F. S. Marvin. (Ivor Nicholson and Watson. 4*s.* 6*d.*)

Mr. Marvin's new volume in the *University Extension Library* is an instructive companion to his well-known book on *The Living Past*. Here again, though from a very different angle, he surveys the world's history in a shrewd and sympathetic fashion. He has, of course, no liking for the fantastic theories of Spengler and others who hold that all civilisations wax and wane like the moon. On the contrary, Mr. Marvin, like most of us, recognises a definite progress—sometimes halting, but never coming to a full stop—in the development of mankind from the Stone Age to our own day. The evolution of reason is for the author the prime fact of human history, and it continues, however slowly and in despite of the temporary checks occasioned by wars and dictators. In an age when pessimism is fashionable and would-be Cassandras find a readier audience than their original had in Troy, Mr. Marvin's cheerful and very accurate sketch of our history is a tonic to be recommended.

His closing chapters on the world as it is are unusually fair. He can recognise, for example, the value of nationalism, however marred by excess in some cases, as a counterpoise to "an over unified and mechanised humanity." Just as the individual should count within a nation, so the nation must count in the international society if freedom and variety are to be secured to the race.

*Papuans of the Trans-Fly.* By F. E. Williams. (Oxford University Press. 30*s.*)

This volume is the fifteenth in a series of anthropological reports prepared under the auspices of the Government of Papua. The author holds the office of Government Anthropologist. It would be difficult to say whether the greater obligation lies on the side of the Government or of science. For if the science of anthropology is indebted to the Administration for a mass of valuable facts, such as those collected in this volume by Mr. Williams, the Administration on its side owes much to the science for its method of approach to the problems of native government and the training of the officials to whom control of the natives is entrusted.

The Keraki, the people with whom Mr. Williams is here concerned, are themselves an example of the improvement in conditions brought about by British rule. Living in the Morehead River district of S.E. New Guinea, which is regularly subject to heavy flooding, they have had neither encouragement nor opportunity to develop an elaborate culture; but the greatest impediment to well-being has been their exposure to frequent head-hunting raids on the part of the Tugeri. Now that these raids have been checked, Mr. Williams records, they are by no means unhappy.

The cultural picture that emerges from Mr. Williams's close and detailed study of the people and their institutions is one which in its more important aspects may be regarded as characteristic in New Guinea. It is a hamlet organisation, based on garden cultivation, with the pig as the important factor in the dietetic and ceremonial arrangements. Inter-group relations, when not warlike, though war is now a thing of the past, are cemented by an elaborate exchange of gifts of produce and food.

Mr. Williams attaches no little importance to the system of exchange-gifts. It is, for example, the basis of marriage, sisters being exchanged. If a sister is not available on one side, adequate gifts must take her place. The author suggests that this, in conjunction with a suggested origin for the social divisions or moieties, may be the origin of exogamy. It is to be noted, however, that the idea that these moieties may have originated from the intrusion of an extraneous element or group, is not borne out by Dr. L. H. Dudley Buxton's analysis of the physical measurements of the people.

Mr. Williams has entered only tentatively, as he is careful to emphasise, into the question of origins; but Dr. Haddon in a valuable introduction is less chary, and has attempted something in the nature of a reconstruction of the ethnological history of the Keraki, with results, as he points out, differing in certain respects from those of the author.

The book will prove of great value to the student of custom; although its merits may not be fully recognised until the author's data take their place in a comparative study of the cultures of the Fly River area as a whole.

*Man and the Sea.* By J. Holland Rose. (Heffer. 10*s.* 6*d.*)

Few can surpass Dr. Holland Rose in knowledge of the ways in which man has essayed to gain mastery of the sea, from the first primitive attempts at a canoe or raft to the mammoths of present-day naval architecture. In his latest book he sketches in considerable detail some of the most pertinent stages in the history of maritime progress. Man is not naturally a seagoing animal, and in general he has taken to the sea only when the land at his disposal was unproductive or otherwise unfavourable to the attainment of the standard of comfort desired.

Dr. Holland Rose compares the early European sailors unfavourably with the primitive Polynesians. These latter appear really to enjoy battling with the ocean, while Odysseus, skilful navigator though he was, never pretended to derive any pleasure from his nautical mishaps. Perhaps this was why the development of the European ship was either slow or spasmodic. Not until the early 15th century was any real attempt made to construct a vessel which was not hopelessly at the mercy of contrary winds. Here again, as our author points out, it was dire necessity that was the mother of invention. The Moslem power, at its zenith, barred the free way to the East, and the search of the South Atlantic for a new road thither, first round the Cape, then westwards to the "Indies" was the outcome; and the construction of seaworthy vessels became a prime consideration. Like much else of the early work of navigation, we probably owe the new ship-design of several masts to the Portuguese.

Early exploration, as has been pointed out before, was prompted by greed of gain, and its results were largely nullified by the desire for secrecy. It was not until the English navigators came on the scene, with their overweening contempt for the foreigner and their consequent abandonment of secrecy as a policy, that the results of exploration became generally known.

Dr. Holland Rose happily devotes many pages to William Dampier, the widely-read, curious, and kindly buccaneer—the really convinced explorer for exploration's sake. Not averse to a good haul from some foreign ship or factory, for the benefit of his crew, he himself was more interested in the strange things and people he saw by the way, and deserves the title, "the

father of ethnology," that our author gives him. But exploration in the modern sense did not begin until the advent of Capt. James Cook. Reading the account of Cook's preparations and precautions, we wonder how it was that previous navigators accomplished anything at all. At all events, Cook, in three voyages, discovered more about the Pacific than all the rest had done in two centuries: as Dr. Holland Rose implies, it was simply because he understood his job.

The chapter on Early Man in the Pacific is of supreme interest, partly on account of its little known theme. The original colonisation of the islands of Polynesia in the very elementary vessels at the disposal of the colonists must have involved a series of voyages of which Bligh's boat journey of 41 days from Fiji to Timor is the only European parallel.

The book closes with a series of separate studies dealing with the naval campaigns of the Napoleonic War and with the suppression of the Slave Trade. That sea power must ultimately prevail is the author's main thesis; and so far history has proved him right.

*Evolution and Heredity*. By CHARLES WALKER. (Black. 6*s*.)

The rediscovery of Mendel's laws of inheritance has had, and continues to have, a profound influence on current ideas of the mechanism of evolution. The last fifteen years have, however, seen a very marked change in the attitude of geneticists towards evolutionary problems. The earlier investigators of heredity emphasised the discontinuous nature of inheritance and went so far as to deny the theory of natural selection on these grounds, rather upholding the merits of the mutation theory of evolution, as propounded by De Vries. This is understandable when it is remembered that the segregant types, with which the earlier work was done, were of a very sharply contrasted nature. More recently attention has been paid to the nature of quantitative differences, to the smaller mutations, and to the interaction of genes with, what may be termed, the genetic environment. The work of Fisher, Haldane, and others has shown that selection is a potent force in determining gene frequencies, that discontinuous mutation can, by its interaction with the gene complex, result in continuous variation, and that "blending" inheritance must be interpreted as the result of segregation of a number of genes producing similar effects. One of the great contributions of genetics to the theory of evolution has been to show that Mendelian inheritance allows of the maintenance of variation, the material for selection, from generation to generation without excessive mutation rates. In the light of these results genetical opinion has been rapidly swinging in favour of the theory of natural selection as the mechanism of evolutionary change.

Professor Walker has been concerned to show that genetics does not disprove natural selection as propounded by Darwin. Though his conclusion is sound it is not based on the considerations outlined above, rather is it the chance outcome of a complete misunderstanding of modern genetics. The attitude which he imputes to geneticists is that which workers in this field adopted twenty years ago. This ceases to be surprising when his bibliography is examined. Rather less than twenty per cent. of the references are to post-war genetical papers and the work of such authors as Haldane, Fisher, Sewal Wright, and Müller is entirely ignored, whereas the more historical references include one to Hunter (1781) and one to Gibbon. The hypothesis of the continuous spireme, long given up by cytologists, is resurrected, and entirely inaccurate statements are made, as for example, that gene mutations have no effect on the viability of the individuals showing them. It is stated that there is not sufficient space in the chromosomes for the presence of enough genes to control all the variable characters of an organism, and that the function of Mendelian inheritance is "to hasten the fixation and elimination of variation in the later stages of evolution." Examples of this kind could be multiplied indefinitely but these serve to illustrate the inaccuracy of fact and confusion of argument of the whole book.

In brief the book is based on an inadequate and unsound knowledge of modern genetics and as a natural result the great majority of the conclusions are erroneous, except in some cases where genetics need not be cited. It cannot in any degree be considered to give a true representation of the contribution of genetics to the understanding of evolution.

K. MATHER.

*Heredity and Evolution*. By A. E. WATKINS. (Murray. 7*s*. 6*d*.)

The rapid advances made in recent years in the twin sciences of genetics and nuclear cytology have rendered possible a new approach to the problems of evolution. As a result a number of works, expounding the views of various geneticists on evolution, have appeared. However, the question is one of such magnitude that any addition to this literature is eagerly awaited.

Mr. Watkins opens with an account of the more elementary aspects of genetics and cytology and then devotes the later chapters to discussing variation, selection, and species formation in the light of these principles.

The genetical and cytological exposition is good as far as it goes. There are some misleading, and a few clearly wrong, statements made, but the chief criticism that can be levelled at this part of the book is that no full account is given of the work of Haldane, Fisher, and Wright on selection, and of Muller and Timoféeff-Ressovsky on mutation. The essential points of these important works are not made clear. The later chapters suffer considerably from this omission. The relations of variation and selection are considerably simplified in presentation, and the importance of Fisher's theory of dominance in providing an explanation for continuous variation as a result of discontinuous mutation is not adequately brought out.

The author tends to emphasise the importance of polyploidy in species formation without pointing out that, as far as we know, polyploidy results only in the combination of the potential variation of two species in one. Such phenomena as the achievement of secondary balance, which appear to have immense importance, at least in the higher plants,are completely neglected.

The author's views on evolution cannot pass as being founded on the whole of recent genetical research or as being typical of those of present-day geneticists. The book does, however, give a sounder and more readable account of elementary genetics and cytology than does most of the contemporary literature.

K. MATHER.

*Genetics*. By H. S. JENNINGS. (Faber and Faber. 15*s*.)

Professor Jennings's book is primarily intended as an elementary account of the subject. A number of such books have been written at various times in the past but the present work differs considerably from most of them both in the illustrative material and in the presentation.

The choice of material cannot be considered as representative since nearly all the phenomena discussed are those relevant to

animals. For example, sex determination is dealt with at considerable length, though without any discussion of the important work of Goldschmidt on *Lymantria* and Winge on *Lebistes*. On the other hand, no account whatsoever is given of the breeding behaviour of polyploids. Polyploidy is an essentially plant phenomenon and much of the present day plant genetical research is concerned with it. An account of the breeding behaviour of polyploid plants would be of almost universal interest since this class includes important crops such as wheat, oats, and tobacco.

Perhaps an even more serious omission is that no account of the interaction of genes is presented. This subject is one that has received much attention recently and has an important bearing on such questions as dominance and evolution. An elementary account of the recent work in this field could hardly fail to be an asset to any book on general genetics.

The treatment is far too academic, the subject being discussed with hardly any reference to the related sciences and none whatsoever to its bearing on some of the important biological problems of the day. There is also an undue amount of repetition. The inheritance of sex-linked factors is described in at least three places. Two features are, however, commendable, viz., the inclusion of a description of various human factors and their breeding behaviour, and the attempt to classify the characteristic features of some phenomena into a series of numbered points.

It must also be noted that the author is confused as to the meaning of some of the terms he employs. For instance, dominance is used both in the original Mendelian sense and in the way current among the Drosophila workers, without any explanation of the difference.

The book cannot be considered as giving an account of modern genetics, being over-long on some topics and omitting others of equal importance. Better and more readable accounts will be found in other publications.

K. MATHER.

*The Philosophy of Physics*. By Professor MAX PLANCK. (Allen and Unwin. 4*s*. 6*d*.)

In this extraordinarily readable book of four essays the author sets out the mortal conflict between the Determinists and their rivals the Indeterminists. Professor Planck explains the fundamental cleavage between the rivals as being due to their declaiming from two entirely different but related platforms. In visualising the conflict it is seen that the Determinists have created for themselves an intellectual structure which represents a world-image or rather a physical world-image. This is a kind of model or idealisation created in order to avoid the inaccuracy inherent in every measurement and to facilitate exact definition. This physical world-image has fulfilled a duty marvellously well so long as little was expected in the matter of highly exact investigation and minute measurement. When the necessity did arise and certain radiation phenomena defied interpretation, the fundamental tenet of the Determinists, causality in Nature, seemed to them to be completely flouted by the brilliant theory put forward by Professor Planck to the effect that Nature's fundamental processes were discontinuous and ultimately unpredictable, but that the discontinuity was capable of exact definition in respect of character but not of its performance.

Planck's quantum theory has, of course, delighted the Indeterminists who deny causality in nature, yet Professor Planck himself pleads for a new Determinism, one which will be able to accommodate his quantum. It is curious to note that this urge to include indeterminacy within the ambit of an all-embracing and rigid determinism is actually a necessity forced upon us. The principle involved is identical with that which determines the freedom or otherwise of the will.

Many years ago Professor Henry Drummond upheld the doctrine that the physical or natural laws were continuous throughout the spiritual world. There would seem to be no reason whatever why they should not be so. Very few nowadays would deny the freedom of the will, nor the doctrine of causality in nature, yet logically the two are incompatible. Some shrewd observer has said that the success of the British nation in world history has been due to their capacity to reconcile utterly illogical situations. Professor Planck has rendered classical physics an outstanding service by importing this capacity into it, while transforming the classical world-image.

*Physical Aspects of Organic Chemistry*. By WILLIAM A. WATERS. (Routledge. 25*s*.)

During recent years new conceptions of molecular structure have led to fresh physical theories of the mechanism of organic chemical reactions; these theories are based ultimately on the electronic structure of the atoms concerned. A very large amount of literature on the subject has been published. *Physical Aspects of Organic Chemistry* is a review of the present position of theoretical organic chemistry.

As is essential with a subject which is rapidly developing, the historical aspect of it is never forgotten. This does not mean that undue attention is in any way paid to theories which have been greatly modified or discarded. In fact, the arrangement of the subject matter is exceedingly well balanced. Each chapter of the book deals with one of the various sections of organic chemistry, as indicated below; usually each of these sections is introduced by a brief, but adequate, historical summary, the most recent developments being the most fully treated. In this way, although in most cases each chapter can be read independently of the rest, a quite good coherence is maintained.

Very detailed attention is not given to a very few specialised theories, but a wide range of organic chemistry is covered. This is a very sound scheme, especially as a full bibliography enables the reader, without trouble, to gain ample information from original papers on any theme that particularly interests him.

In the first five chapters are considered theories concerning the fundamental nature of molecules and of chemical actions in general. Chapter XI, "General Polarity," might be grouped with these, in which molecular structure, chemical affinity, the principal types of valency, electrical dipoles, activation, and chemical reactivity are among the topics discussed. A chapter on unsaturation, with reference to azides and aliphatic diazo compounds, follows. There is a useful chapter on free radicals. Active organic substances (like organo-metallic compounds and the Grignard reagents) which are used as reagents, and the function of anionoid and kationoid reagents in ionic reactions are treated; and, in a chapter on the reactions of the halogens, certain common reactions, like the Friedel-Crafts reaction, are considered. Modern conceptions of acidity and of the mechanism of hydrolysis and esterification are described.

The interest of the book is enhanced by the occasional inclusion (unusual in books of its kind) of actual extracts from original papers. There is an introduction by Professor T. Martin Lowry. A subject and an author index are appended.

This book should be of interest to all organic chemists. In

particular it can be strongly recommended to those students of the subject who find it difficult to gain a sufficiently adequate knowledge of the theories and conceptions which the book describes.

*Men and Mountains*. By N. Ilin. Translated by Beatrice Kinkead. With a Preface by Maxim Gorky. (Routledge. *7s. 6d.*)

This is another Soviet geography book of the type already too familiar. It is a simple-minded form of propaganda, useless in English because incomprehensible to those who do not know, and unnecessary to those who do. Even if we make allowance for the excellent research work now being done in Russia, this form of popularisation does not do much to glorify the workers. It reads like journalism and is often an intelligent anticipation of events. The original is clearly addressed to adult children in Russia, to whom it is no doubt useful and impressive; the translation is addressed to English and American children, but they will not understand very much of it.

It accepts Wegener's theory as a fact. It alludes to the Karst as a "disease of rock," tells us that the "Sahara desert is bordered by the Arctic," and condemns the capitalist system for shelving the project of Professor Schwarz, that the "rivers Kipipe and Chobe in southern Africa be dammed up and their waters turned into the Sahara desert." And the author reminds us that the Bolsheviks have retained at least one old bourgeois prejudice, that it is desirable to convert a nomad into an agriculturist.

The translation is well enough done as far as it goes, but distances are left in kilometres and the names of plants in the vernacular. What English child would recognise a *karagach*? Why not call it what it is, a kind of elm? And what on earth is the *kandym*? It is meant for *kandyr*, the Kirghiz name for hemp; or for *kandyk*, the dog-tooth violet (*Erythronium dens canis*, L.); or is it *kendir*, the well-known fibrous plant *Apocynum venetum*?

Kalmik, instead of the English Kalmuck or the Russian Kalmyk, is probably a misprint, but why retain the Russian form of thorium? "Chorozemsku Oasis" is clearly an oversight as well as a misprint, for on another page we find Horezm, which may be accepted as the modern form of the ancient Persian name (usually written in English Khwarezm) which the Soviets have revived for Khiva. And whoever on this side knows who are the Lopari? In English we call them Lapps. All of which shows that a translator requires more than a mere knowledge of two languages. He must also understand the subject. But until translators are adequately remunerated, they cannot be expected to give time to research upon obscure points.

The sketches are better than the text, except that the reversed fault, on p. 226, is inverted.

Malcolm Burr.

*The St. Lawrence Deep Waterway*. By C. P. Wright. (Macmillan. *18s.*)

The problem which this book deals with has been the subject of surveys and of engineering studies for fifteen years. The conquest of the St. Lawrence rapids is to make possible the development of five million hydro-electric horse-power and to enable ocean-going steamships to sail up into the Great Lakes. In July, 1932, a treaty was signed by the Canadian Government and the United States, though it has not yet been ratified. The engineering studies seem unimpeachable. Dr. Wright's conclusion in reference to them is that "in its technical aspects the whole colossal undertaking would seem to be perfectly sound."

In contrast, however, with the engineering studies, the economic prospects of the undertaking have not, in the author's opinion, received scientific consideration. The object of the author in this book is not to take a side in the controversy or to present definite recommendations, but to supply the material and the careful consideration for a decision. He is, however, quite certain in his own mind that the deep water scheme should not be envisaged by itself, but in conjunction with the related development of the Upper and Lower St. Lawrence; and that the interests of Canada and the United States must be considered together in the St. Lawrence basin as a whole. There are chapters on the United States Senate Enquiry and on the Beauharnois Development Scheme.

*Gibbon*. By R. B. Mowat. (Barker. 10s.)

Professor Mowat's new book on Gibbon deserves a warm welcome for one obvious reason. It is an extremely interesting introduction to the study of the greatest English historian, one of the greatest, and perhaps the most typical, of all European men of letters in the latter part of the 18th century. The book fulfils two purposes admirably. It gives a kindly and truthful picture of its subject, and it paints in the background with a competent and impartial hand. It does not aim at superseding Gibbon's own account of himself in his memoirs; it rather increases one's appetite for these. But it is better than the memoirs in one respect, that it draws on other sources of information—Boswell, Maria Holroyd, and many other contemporaries who give impressions of Gibbon in their own letters or memoirs.

Characteristic of Gibbon himself is the inexhaustible intellectual appetite which sent him to Hunter's lectures on anatomy and Higgins' lectures on chemistry. One does not understand why Professor Mowat finds his taste for Hunter's lectures on anatomy "curious." Hunter was one of the leading scientific explorers of his day and performed, as a surgeon, operations which "attracted the attention of all Europe."

The meetings recorded with Pitt, Fox and, Dr. Johnson are also highly characteristic of the man. Fox was genial and acceptable, as he was to every one. Pitt, as a young man, at his first meeting with Gibbon, offended him greatly. He had the presumption to question some of the older man's confident *obiter dicta*, and, worse still, to press his objections to a triumphant issue. Gibbon, on this occasion mastered in argument, stalked out of the room. In his meeting with Johnson, who was noted as a bear, he seems to have avoided an argumentative contest. Of all the personal contacts recorded in the book, that with the Duke of Gloucester is the most exquisitely amusing:—"What, Mr. Gibbon, another thick square book! Always scribble, scribble, eh, Mr. Gibbon?"

Characteristic rather of the age than of Gibbon personally, is the perfectly shameless use of Government sinecures as a reward for faithful support of the Government. Bear as he was, one's heart goes out rather to Johnson, fighting for his life in a garret, than to the comfortable epicure like Gibbon who managed his life so that he could have the entry of all the best clubs in London and all the best salons in Paris.

The concourse of Englishmen in Paris, and on the Continent generally, was also a notable feature of later 18th century life.

There are said to have been some forty thousand of them somewhere in western Europe in 1783. Gibbon himself was always wavering between being a cosmopolitan and a patriotic Englishman. As he came back from Lausanne for his last illness, and died in London, we must give a final vote for his Englishry; but it is fair, and characteristic, to note that it was attachment to his friends, rather than anxiety for himself, which prompted this journey. Lord Sheffield, his greatest friend, lost his wife in 1793 and Gibbon started at once to come back and console him.

The best extract from Gibbon given in Professor Mowat's book is unquestionably the passage at the end of Volume VI of the *Decline and Fall*, where he reflects on the "awful revolution," which he has been describing, and how far we may expect mankind to survice such experiences and continue on the upward path. Herein he is the chil l of his age on its best side —the side of Condorcet; and it is a lesson which may well be repeated at the present day.

*Everest: The Challenge.* By Sir Francis Younghusband. (Nelson. 12*s.* 6*d.*)

Although it was conceived and half written before he knew that the present Everest Expedition was to be sent to the Himalaya, Sir Francis Younghusband's book may well be called a handy introduction for those who are following with interest the fortunes of that expedition. Here are a historical background, accounts of previous expeditions not only to Everest, but also to Kamet, Kanchenjunga, Nanga Parbat, Trisul, and other Himalayan peaks, and an estimate of the chances of success in the future. But there is more in the book than this; there is a mountain-lover's philosophy.

At one time the most ambitious climbers took it for granted that the higher Himalayan summits were beyond man's powers of attainment. But by degrees man has become more optimistic; each new altitude record has increased his belief in his power to go still higher, and it has been shown that the human organism can adapt itself to the atmospheric conditions to be met at the highest altitudes. When the Everest expeditions were begun it was doubtful whether it would be possible to reach 26,000 feet without oxygen. To-day we know that man can climb to the 28,000 feet level without it; and the climbers of 1936 will not be worried by the uncertainty of the effects of altitude.

It may be possible this time for a camp to be established at 28,400 feet on the face of the final pyramid because the porters' spirit and mountain craft has also improved with each expedition. Then, if two climbers can be "nursed" to that height the victory may at last be won, although "the weather it is that decides." Sir Francis believes "that even if Everest is only moderately lenient they will succeed."

A chapter on the Himalayan peoples, whose share in these expeditions has been so great, completes that part of the book entitled "Adventure." The rest is called "Reflection." Mountains, and the Himalaya in particular are to Sir Francis a form of religion. Many of us know the uplifting of spirit that high places can give but few can put their feelings into words as he does. He dreams of pilgrimages to these holy mountains. "Everest," he writes, "might well be the symbol of the fellowship, and its practice a reverent worship of all that is most high and pure and lovely wherever found."

Reading this book it is not difficult to share the author's exaltation in some part even though the reader may not have had the good fortune to have lived with the Himalaya. For such, photographs as good as those reproduced in this book mean much, and if there is a jarring note in it anywhere, it is in this passage in the Preface: "I have a hatred of all photographs of the Himalaya. They degrade the mountains in the minds of all who have seen them. But in the eyes of those who have not seen them, photographs are supposed to give some slight impression of what the mountains are like, so I reluctantly comply with my publisher's request to include some." Readers will be grateful to the publisher for his insistence.

*Guide to the Reports of the Royal Commission on Historical Manuscripts*, 1870-1911. (Part II, Index of Persons.) Edited by Francis Bickley. (H.M. Stationery Office. 12*s.* 6*d.* and 15*s.*)

This is Section I (A-Lever) of a very remarkable and valuable work. It is a personal index to the collection of volumes of the Historical Manuscript Commission as issued down to the year 1911. It comprises (on a rough estimate) about 27,000 entries. This great combined Index is, naturally, compiled from the indexes of the various Reports already issued. What makes the combined Index particularly valuable is that the name of every person on the list is not merely referred to the appropriate Report, but is identified in the combined Index by a note of the family, the profession, or (this is always indicated) the date. The book is really a very compendious Dictionary of Historical Persons, chiefly, though by no means entirely, British, with a reference in each case to that rich source of information, the volumes of the *Historical Manuscripts Commission.*

*Modern Alchemy.* By Dorothy M. Fisk. (Faber and Faber. 6*s.*)

Intended for "the enquiring adult or enquiring schoolboy," this account of such subjects as the electrical nature of the atom, radioactivity, the bombardment of atoms, and the transmutation of metals, is written in an up-to-date manner and is reasonably lucid for the general reader. One of its most interesting features is centred in the ten diagrams and tables, which are self-explanatory and give much more information than would be possible in a page of text. The practical uses which may ultimately evolve from transmutations are dealt with very briefly. It might also have added to the general interest of the book if a few portraits of pioneers in the subjects concerned had been included; apparatus used in their investigations has been very wisely omitted.

*The Spelling of English.* By Thomas Arncliffe. (The Eagle Press, Wakefield. 7*s.* 6*d.*)

By the introduction of six new letters into the Alphabet, Mr. Arncliffe brings the spelling of English into some sort of logical method. Unlike many spelling reformers, he respects tradition and the "look" of a word. The ingenuity of his scheme makes it an interesting study, and the attractive printing of the book affords pleasant reading.

In the April issue of Discovery, C. H. Waddington's book, *How Animals Develop*, was reviewed under the title "How Organisms Develop." We have pleasure in calling readers' attention to the correct title.

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